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# ON THE AFFINITIES OF TARSIUS: A CONTRIBUTION TO THE PHYLOGENY OF THE PRIMATES.

BY CHARLES EARLE.

In order to form a just estimate of the zoological rank of an animal in the system we must take into consideration its whole organization and development. Any system of classification which only considers one set of organs at the exclusion of the others will probably lead to false ideas as to the systematic position of the animal in question. In endeavoring to determine the relationship of *Tarsius* to the other members of the Primates, we are met at the outset with that great difficulty in morphological enquiry to decide between characters due to inheritance and those arising from convergence. The phenomenon of homoplasy is being recognized more and more by naturalists, and it is only by a complete knowledge of the palæogenetic history of a phylum that we can decide surely whether certain characters of the skeleton, common to it and to other phyla, are homogenetic or homoplastic in their origin.

*Tarsius* stands preëminently among Mammals as one of the most interesting of generalized types, for in this genus we have an animal whose assemblage of characters relates it on one hand to the Apes, and on the other surely to the Lemurs. The question arises, is the position tenable if I maintain that as *Tarsius* exhibits many fundamental structural peculiarities

only found in the Apes and Lemurs, as a result the Anthropoids and Lemuroids may be considered genetically related. I may add that the palæontological evidence supports this conclusion.

I find on further study that Mivart's views concerning the relations of the Lemurs and Apes are most unsatisfactory. He considers that the question of genetic relationship in classification should take a subordinate place, and if two groups of animals exhibit characters in common, it makes little difference whether the characters be due to convergence or were inherited from a common ancestor which gave origin to the two aggregations in question. In short, to Mivart classification is merely a convenience, and may or may not denote genetic relationship. Applying these principles to the arrangement of the Primates, Mivart merely placed the Lemurs and Apes together because they exhibit some characters in common, and not that he considered these two suborders of the Primates closely related. Since Mivart's important paper on " Lepilemur and Cheirogaleus " was written in 1873, great strides have been made in arranging some of the Mammals based on the true scientific principle of community of descent. A good example of the determination of adaptive versus essential characters is the case of the Carnivora, where the important discoveries of vertebrate palæontology clearly demonstrate that the Bears and Dogs are related, but the Mustelines, instead of being connected with the Bears, are related to the Civets. Again, the Hyenas came off the same stem as the Mustelines, and are related also to the Viverrines and not to the Cats, as supposed by Flower.

Burmeister, the monographer of *Tarsius*, considered this animal to be a Lemur, but with characters relating it to the Apes and also to the Insectivora. Burmeister's views as to the relationship of *Tarsius* is shown in the following passage from his Memoir: "Aber *Tarsius* ist nicht mal ein Affe, er ist vielmehr nur ein Halbaffe, ein Mitglied jener Gruppe, innerhalb welcher die frugivore oder zugleich omnivore Nahrung der hochsten Säugethiere in die ausschliesslich animalische zunächst insektivore, uberspringt." That Burmeister fully appre-

ciated the essentially lemurine characters of *Tarsius*, and which I should like to emphasize, do not occur in any other Mammalian group except in the Lemurs, is evident from his paper. Hubrecht, who has recently written an important paper on the placentation of *Tarsius* insists on the close relationship between this genus and the Apes. Because Hubrecht finds that the histological structure of the placenta and the stalk connecting it with the embryo in *Tarsius* is structurally like that of the Anthropoids, he proposes to overthrow our present system of classification of the Primates, dividing this group into two distinct orders, and placing *Tarsius*, also the fossil genus *Anaptomorphus*, among the Apes. I believe that Hubrecht, in his discussion of the systematic position of *Tarsius*, has not taken into consideration the whole organization of this genus, and furthermore I am of the opinion that any classification of the Mammalia depending solely on the structure of the placenta and its connections will prove to be unreliable.

I am aware that there are many difficulties in the way of claiming that Lemurs and Apes are genetically related, but if one eliminates some of the highly adaptive and specialized characters of the Lemurs, which appeared late in their evolution, then these two groups of Mammals approach each other very closely and on osteological characters alone, we are unable at present to surely separate the early Lemurs from the Apes. In other words, the extinct Lemurs possess certain characters which are now found widely separate in the two suborders of recent Primates.

In order to allow the reader to form an unbiased opinion of the affinities of *Tarsius*, I will briefly review Hubrecht's important contribution to the placentation of *Tarsius*, and follow him in his comparison of the placental connections of *Tarsius* with that of *Erinaceus*, a typical Insectivore, and also compare both with what is known of the placentation in the true Lemurs.

In the early as in the later stages of *Tarsius*, the yolk sac only takes up a small portion of the cavity of the blastocyst, and there is never present an omphaloide placentation as in *Erinaceus*. In this character of its development *Tarsius* strictly follows the plan of the Anthropoids.

A very important point in the early development of *Tarsius* is that the surface of the chorion never becomes entirely villous as in man. In *Cercocebus* the villosities of the chorion are limited to dorsal and ventral areas. The fact that *Tarsius* has omitted this diffuse stage of the placenta found in the true Anthropoids, clearly shows that this is a specialization in the development of this genus. Hubrecht remarks in referring to this completely villous stage of the chorion of the Anthropoids: " Ich halte den Zustand welcher beim Menschen und Anthropoiden sich erhalten hat, tur sehr primitive." Again, he says: " Somit neige Ich zu der Ansicht hin, dass in diesem ununterbrochenen Zottenpelz ein primitiver charakter erhalten, und dass die partielle Zottenbildung von Niederen Affen, wie der Fig. K giebt; eher als ein abgeleiterer Zustand zu betrachten sei."[1] The reference he gives to Fig. K is the condition found in *Cercocebus*, where the villous areas of the chorion are restricted to patches above and below the fœtus. In *Erinaceus* the amniotic cavity is formed by a splitting of the epiblast, so that the portion of this membrane below the amnion is the only part directly concerned in the growth of the embryo; accordingly Hubrecht designates this as the epiblast proper, whereas the remainder of the epiblast not used in the formation of the embryo he calls the trophoblast. Prof. Hubrecht considers the development of the amnion as occuring in *Erinaceus* the primitive one, whereas the more ordinary way by folds growing over the embryo and uniting, as a secondary process. *Tarsius* follows the more normal formation of the amnion by the folding off of the embryo.

In an early stage in the development of *Tarsius*, there occurs a thickening in the external epiblast or trophoblast, and on the opposite side from the embryonic area, this is the placental " anlage " or rudiment. It is important to notice that the first indication of the placenta is situated ventrally in relation to the embryo, as in the Apes it is dorsal. Again, the origin of the placenta in *Tarsius* has no connection whatever with the allantois, and the latter organ never becomes directly connected with the placenta as will be shown later. At the time

[1] Die Keimblase von Tarsius, Leipzig, 1896, pp. 171 and 172.

of the origin of the placental "anlage" in *Tarsius* the whole blastocyst is lined by the mesoblast and in the portion of the latter which connects the placental anlage with the posterior end of the embryo, originates a very important structure, highly characteristic of the Anthropoids; this is the bauchstiel or ventral stalk. Prof. Hubrecht explains the genesis of the bauchstiel very clearly, and shows that as the embryo becomes folded off from the yolk by the development of the amnion, that this mesoblastic strip is carried with the embryo until the latter is really suspended in the cavity of the blastocyst, its only attachment to the wall of the same is by means of the bauch- or haftstiel as he calls it. Vascularization of the ventral stalk soon takes place by blood-vessels arising in it, and thus embryo and placenta are brought into vascular connection. Another very important point shown by Hubrecht is that the portion of the bauchsteil next to the embryo is permeated by two tubes, the dorsal is a prolongation of the amnion and the lower is the rudiment of the allantois. The latter is one of the most important discoveries made by Hubrecht in connection with the development of *Tarsius*, as he demonstrates that in *Tarsius*, as in the Apes and Man, the allantois is rudimentary and does not hang freely in the coelomic cavity as in the rest of the Mammalia. Prof. Hubrecht shows that the allantois rudiment takes no share in the vascularization of the bauchstiel as the following quotation proves: "Finden wir in dem Haftstiel eine verhältnissmässig langen Restbestand dieses Allantois rohres, welches aber, wie bereits auseinander gesetzt wurde, an der Vaskularisation des Haftstiels keinerlei antheil hat." Professor Hubrecht compares an early stage of *Erinaceus*, before the splitting of the mesoblast (see his paper, stage 2), with that of *Tarsius* (fig. 7), in order to prove that *Erinaceus* has a sort of bauchstiel, connecting the rear end of the embryo with the trophoblast. In this stage of *Erinaceus* the extent of the mesoblast is very limited, but in *Tarsius* the whole blastodermic vesicle is lined by mesoblast.

Turning now to the fœtal membranes of the Lemurs, we find there is apparently little in common between the placentation of these animals and *Tarsius*. In *Tarsius* the placenta is dis-

koidal-deciduate, whereas in the Lemurs it is diffuse and nearly the whole surface of the chorion is villous. It appears then that we are dealing with two types of placentation fundamentally different in structure and origin; however, the early development of the placenta in the Lemurs is totally unknown so far as I have been able to learn. Turner has described the placentation in the genus *Lemur*, and Alphonse Milne-Edwards in the Indrisine Lemurs. In all known forms of Lemurs the allantois is a huge sac enveloping the embryos, and often having numerous diverticulæ. Milne-Edwards calls attention particularly to one point, that the external layer of the allantois has no intimate connection with the chorion, and moreover it is not vascular. The question then arises, if the allantois takes no share in the formation of the placenta in the Lemurs, the latter organ probably originates from the chorion as in the Apes. This point is not yet proven, and it remains for further research to find out how the connection between fœtus and chorion is brought about in the Lemurs.

Dr. Charles Sedgwick Minot, to whom I am greatly indebted for an important letter on the question of the placentation of the Primates, in his great work on "Human Embryology," divides the placentation of the Mammalia into two types, in the first group the allantois is large and supplies the chorion with its blood-vessels; this is the condition occurring in the majority of the Mammalia, excepting some of the Primates. In the more highly differentiated Anthropoidea, the allantois takes no part in the formation of the placenta, and the blood-vessels arise in the chorion and bauchstiel *in situ*. Dr. Minot designates this type as chorionic placentation. I quote two passages from his letter which have an important bearing on the question of the relations of the placentation of the Apes to that of the Lemurs: "Unfortunately, nothing satisfactory is known of the early stages of Lemurs, which are the critical ones for placental homologies, but as far as our fragmentary knowledge goes, I fail to recognize any impossibility of regarding the placentas of Monkeys and of Lemurs as of one fundamental type." Again Dr. Minot says: "Whether a placenta is diffuse or not cannot decide as to its homologies, for the

human placenta is diffuse to start with, yet has nothing in common with the Ungulates, *though it may be compared, apparently, directly with that of the Lemurs.*"

I am not, at present, in a position to discuss the whole organization of the Lemurs, and will merely refer to the brain and female reproductive organs. In regard to the structure of the brain in the Lemuroidea, it may be said that the genus *Lemur* has a lower type of encephalon than is found in the *Indrisinæ.* As compared with the *Insectivora*, the brain of the Lemurs is in a much higher stage of development, and approaches nearer that of the *Cebidæ* than any other group. In *Lemur* the frontal lobes of the cerebrum are narrow, and the olfactory lobes are plainly visible in front; however, in *Propithecus*, the frontal portion of the cerebrum is quite highly developed, being as broad as in the American Monkeys, and contains secondary convolutions not seen in the lower forms of Lemurs. Again it is to be noted that in the Lemurs as in the Apes, the sylvian fissure is largely developed and extends a good ways superiorly on the hemispheres, and this character is particularly noticeable in the *Indrisinæ.* The antero-temporal sulcus is also well-marked in the Lemur's brain, and resembles this fissure in the Anthropoids. The posterior lobes of the cerebrum remain in a primitive condition, and the cerebullum is exposed as in the lower Mammalia. Prof. Flower calls particular attention to the presence in the brain of the Lemurs of the calcarine fissure which is so characteristic of the higher Primates, and speaking in general of the sulci of the inner part of the cerebrum of the Lemur's brain, Prof. Flower remarks that they follow also those of the Anthropoidea. The general configuration of the frontal lobes in *Nyctipithecus* among American monkeys is like that of *Propithecus*, but in the former the surface of the hemispheres is smoother and lacks the smaller convolutions seen in the *Indrisinæ.* Again, in *Nyctipithecus* the olfactory lobes project considerably beyond the cerebrum. In conclusion it follows from the above that the brain of the Lemurs is much more primitive than that of the Apes, but may represent a stage in the evolution of the brain which leads to the higher differentiated encephalon of the Anthropoids.

(*To be continued.*)

# BIOLOGICAL STUDIES IN MASSACHUSETTS. NO. 2.

By George C. Whipple.

## MICROSCOPICAL ORGANISMS.

The examination of nearly forty thousand samples of water in Massachusetts collected from water supplies differing in locality and character, and extending through all seasons for a long term of years serve to give us a good idea of the micro-organisms inhabiting the fresh waters of this region. But, in studying them it must be remembered that the examinations were made from a sanitary standpoint, and that from the manner in which the samples were collected they include only such forms as are found floating in the water: the littoral forms are not represented except as they have become detached and accidentally carried into circulation.

The following table gives the names of the genera thus far observed. They are arranged according to the usual system of classification, and each class is divided into groups, according to abundance and frequency of occurrence. The first group includes those genera which, in their season, are often found in large numbers; the second group includes those which are only occasionally found in large numbers; the third those which often occur in small numbers; the fourth those which are rarely observed. This division, while not wholly satisfactory, enables us to separate the important from the unimportant forms. As observations multiply, the list will doubtless be extended and many genera will be changed from one group to another. The names printed in heavy type indicate that the organisms so marked have been the cause of trouble in a water supply.

### DIATOMACEÆ.

*Commonly found in large numbers.* **Asterionella,** Cyclotella, **Melosira,** Synedra, **Tabellaria.**

*Occasionally found in large numbers.* Diatoma, Fragilaria, Nitzschia, **Stephanodiscus.**

*Commonly found in small numbers.* Epithemia, Gomphonema, Navicula, Stauroneis.

*Occasionally observed.* Achnanthes, Amphiprora, Amphora, Bacillaria, Cocconeis, Cocconema, Cymbella, Diadesmis, Encyonema, Eunotia, Grammatophora, Himantidium, Isthmia, **Meridion,** Odontidium, Orthosira, Pinnularia, Pleurosigma, Schizonema, Striatella, Surirella, Tetracyclus.

CHLOROPHYCEÆ.

*Commonly found in large numbers.* Chlorococcus, Protococcus, **Scenedesmus.**

*Occasionally found in large numbers.* Cœlastrum, Cosmarium, **Palmella, Pandorina,** Polyedrium, Raphidium, Staurastrum, **Volvox.**

*Commonly found in small numbers.* Closterium, Conferva, Desmidium, Euastrum, Eudorina, Gonium, Micrasterias, Ophiocytium, Pediastrum, Sphaerozosma, Staurogenia, Tetraspora, Ulothrix, Xanthidium.

*Occasionally observed.* Arthrodesmus, Bambusina, Botryococcus, Characium, Chaetophora, Cladophora, Dactylococcus, Dictyosphaerium, Dimorphococcus, Draparnaldia, Gloeocystis, Hyalotheca, Mesocarpus, Nephrocytium, Penium, Selenastrum, Sorastrum, Spirogyra, Stigeoclonium, Tetmemorus, Zygnema.

CYANOPHYCEÆ.

*Commonly found in large numbers.* **Anabaena, Clathrocystis, Coelosphaerum, Microcystis.**

*Occasionally found in large numbers.* **Aphanizomenon,** Chroöcoccus, **Oscillaria.**

*Commonly found in small numbers.* Aphanocapsa.

*Occasionally observed.* Gloeocapsa, Lyngbya, Merismopedia, Microcoleus, **Nostoc,** Rivularia, Sirosiphon, Tetrapedia.

FUNGI.

*Commonly found in large numbers.* **Crenothrix.**

*Occasionally found in large numbers.* Cladothrix.

*Commonly found in small numbers.* **Beggiatoa,** Leptothrix, Moulds.

*Occasionally observed.* Achlya, Leptomitus, Saprolegnia, Sarcina, Spirillum.

RHIZOPODA.

*Commonly found in small numbers.* Actinophrys, Amoeba.

*Occasionally observed.* Arcella, Cyphodera, Difflugia, Euglypha.

INFUSORIA.

*Commonly found in large numbers.* **Cryptomonas, Dinobryon, Peridinium, Synura, Uroglena.**

*Occasionally found in large numbers.* Bursaria, Chloromonas, **Glenodinium, Mallomonas, Raphidomonas.**

*Commonly found in small numbers.* Anthophysa, Ceratium, Cercomonas, Codonella, Epistylis, Monas, Tintinnus, Trachelomonas, Vorticella.

*Occasionally observed.* Acineta, Chlamydomonas, Coleps, Colpidium, Euchelys, Euglena, Euplotes, Glaucoma, Halteria, Heteronema, Nassula, Paramaecium, Phacus, Pleuronema, Raphidodendron, Stentor, Syncrypta, Trichodina, Uvella, Zoothamnium.

ROTIFERA.

*Commonly found in small numbers.* Anuraea, Conochilus, Polyarthra, Rotifera, Synchaeta.

*Occasionally observed.* Asplanchna, Colurus, Eosphora, Floscularia, Lacinularia, Mastigocerca, Microcodon, Monocerca, Monostyla, Noteus, Sacculus, Triarthra.

CRUSTACEA.

*Commonly found in small numbers.* Bosmina, Cyclops, Daphnia.

*Occasionally observed.* Alona, Cypris, Diaptomus, Sida.

MISCELLANEOUS.

*Occasionally observed.* Acarina, Anguillula, Batrachospermum, Chaetonotus, Gordius, Hydra, Macrobrotus, Meyenia, Nais, Spongilla; besides spores, ova, insect scales, pollen grains, vegetable fibres and tissue, yeast cells, starch grains, etc.

An examination of the following table, a numerical summary of the preceding list, brings out some interesting facts:—

It will be observed that 186 genera have been reported, 108 plants and 78 animals. Of these only 18 are commonly found in large numbers, 13 plants and 5 animals. Twenty-one more are occasionally found in large numbers, 16 plants and 5 animals. Forty-one genera are frequently seen in small numbers, while 106 genera, or more than one-half of all are seen occasionally, some of them but rarely. The most important classes are the Diatomaceæ, Chlorophyceæ, Cyanophyceæ and Infusoria, as shown by the large number of genera and by their greater abundance. Furthermore, these classes include all but one of the 23 troublesome genera that have been found in large numbers. Eleven genera may be said to be very troublesome, because of their wide distribution, the frequency of their occur-

TABLE NO. 1.

| Classification. | Number of Genera. | | | | |
|---|---|---|---|---|---|
| | Commonly found in large numbers. | Occasionally found in large numbers. | Commonly found in small numbers. | Occasionally observed. | Total. |
| Diatomaceæ | 5 | 4 | 4 | 22 | 35 |
| Chlorophyceæ | 3 | 8 | 14 | 21 | 46 |
| Cyanophyceæ | 4 | 3 | 1 | 8 | 16 |
| Fungi | 1 | 1 | 3 | 5 | 10 |
| Rhizopoda | 0 | 0 | 2 | 4 | 6 |
| Infusoria | 5 | 5 | 9 | 20 | 39 |
| Rotifera | 0 | 0 | 5 | 12 | 17 |
| Crustacea | 0 | 0 | 3 | 4 | 7 |
| Miscellaneous | 0 | 0 | 0 | 10 | 10 |
| Total | 18 | 21 | 41 | 106 | 186 |

rence, and their unpleasant effects. They are Asterionella, Anabaena, Clathrocystis, Coelosphaerium, Aphanizomenon, Oscillaria, Dinobryon, Peridinum, Synura, Uroglena and Glenodinuim. This list seems like a short one when one considers the annoyance that the micro-organisms have caused in the various water supplies of the State.

The following tables, compiled from the examinations of the State Board of Health, serve to give one an idea of the distribution of the various classes of organisms in ground waters and surface waters. In most cases the numbers given are the averages of monthly examinations extending over one or more years. They were selected with a view to showing the greatest range in the number of organisms in the classes of water tabulated, and they illustrate in a striking manner the comparative absence of organisms (except Fungi) in springs, wells and filter galleries: the presence of a variety of organisms in small numbers in rivers, and the abundance of microscopic life in the more quiet waters of ponds and artificial reservoirs. It is only in waters of the latter class that the microscopical organisms occasion much trouble by their excessive growth, and hereafter they alone will receive our consideration.

## TABLE No. 2.

MICROSCOPICAL ORGANISMS IN GROUND WATERS.
(NUMBER PER C. C.)

| No. | Locality. | Time. | Diatomaceæ. | Chlorophyceæ. | Cyanophyceæ. | Fungi. | Rhizopoda. | Infusoria. | Rotifera | Total Organisms. | Zoogloea (Units). |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | SPRING WATERS. | | | | | | | | | | |
| I | Spring in Westport | Apr. 21, 1894 | 455 | 0 | 3 | 0 | 0 | 0 | 1 | 459 | 0 |
| II | Aqua Rex Spring, Millis | Aug. 27, 1894 | 1 | 180 | 0 | 0 | 0 | 0 | 0 | 181 | 0 |
| III | Craig Spring, West Springfield | May 16, 1893 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 16 |
| IV | Spring in Ipswich | July 27, 1892 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| V | Spring in Pepperell | Nov. 26, 1894 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 4 | 0 |
| VI | Massasoit Spring, West Springfield | May 16, 1893 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| VII | Spring in Ware | July 17, 1893 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| VIII | Spring in Medfield | Aug. 31, 1894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IX | Spring in Pittsfield | Aug. 27, 1894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X | Cold Spring, Plymouth | July–Dec., 1894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | WELL WATERS. | | | | | | | | | | |
| I | Tubular Well, Provincetown | 1894 | 0 | 0 | 0 | 3130 | 0 | 0 | 0 | 3130 | 50 |
| II | Tubular Wells, Revere | 1894 | 1 | 0 | 0 | 281 | 0 | 0 | 0 | 282 | — |
| III | Large Collecting Well, Marblehead | 1894 | 0 | 0 | 0 | 173 | 0 | 0 | 0 | 173 | 8 |
| IV | Tubular Wells, Hyde Park | 1893–4 | 2 | 0 | 0 | 68 | 0 | pr. | 0 | 70 | 18 |
| V | Tubular Wells, Malden | 1891–3 | 5 | 0 | 1 | 1 | pr. | 1 | 0 | 8 | 7 |
| VI | Tubular Wells, Lowell | 1893 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | — |
| VII | Tubular Wells, Melrose | 1894 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | — |
| VIII | Tubular Wells, Bradford | 1893 | 0 | 0 | 0 | 1 | 0 | pr. | 0 | 1 | 547 |
| IX | Well, Needham | 1894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| X | Well at Fitzwilliam, N. H | 1893 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | FILTER GALLERIES. | | | | | | | | | | |
| I | Filter Gallery at Reading | 1891–4 | 3 | 0 | 0 | 3506 | 0 | 2 | 0 | 3511 | 726 |
| II | Filter Gallery at Wayland | 1891 | 15 | 4 | 1 | 1706 | 0 | 3 | 0 | 1729 | 71 |
| III | Filter Gallery at Whitman | 1891 | 1 | 0 | 0 | 137 | 0 | 0 | 0 | 138 | 41 |
| IV | Filter Gallery at Watertown | 1892 | pr. | 0 | 0 | 217 | 0 | 0 | 0 | 217 | 72 |
| V | Filter Gallery at Framingham | 1891 | 1 | 0 | 0 | 137 | 0 | 0 | 0 | 138 | 41 |
| VI | Filter Gallery at Braintree | 1894 | 0 | 0 | 0 | 34 | 0 | 2 | 0 | 36 | 94 |
| VII | Filter Gallery at Woburn | 1891 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| VIII | Filter Basin at Taunton | 1891–4 | 86 | 2 | 4 | 24 | 0 | 48 | 1 | 165 | 14 |
| IX | Fil'er Basin at Newton | 1892–4 | 2 | 1 | 0 | 15 | 0 | pr. | 0 | 18 | 13 |
| X | Filter Basin at Waltham | 1892 | 17 | 0 | 0 | 0 | 0 | pr. | 0 | 17 | 4 |

## Table No. 3.

MICROSCOPICAL ORGANISMS IN SURFACE WATERS.
(Number per c. c.)

| No. | Locality. | Time. | Diatomaceæ. | Chlorophyceæ. | Cyanophyceæ. | Fungi. | Rhizopoda. | Infusoria. | Rotifera | Total Organisms. | Zoogloea (Units). |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RIVERS. | | | | | | | | | | |
| I | Stony Brook, Influent to Basin 3 | 1891-2 | 77 | 23 | 43 | 38 | 1 | 9 | 0 | 191 | 97 |
| II | Mill River at Taunton | July-Sept. 1893 | 3 | 25 | 1 | 165 | 1 | 4 | pr. | 199 | 676 |
| III | Merrimac River at Lawrence | 1891-4 | 66 | 21 | 2 | 13 | pr. | 4 | pr. | 106 | 156 |
| IV | Ipswich River | 1892 | 12 | 1 | 0 | 87 | 0 | 5 | 0 | 105 | 31 |
| V | Blackstone River at Uxbridge | 1892 | 17 | 6 | 0 | 3 | 0 | 74 | pr. | 100 | 364 |
| VI | Sudbury River, Influent to Basin 2 | 1891-2 | 45 | 16 | 2 | 32 | pr. | 3 | pr. | 98 | 128 |
| VII | Cold Spring Brook, Influent to Basin 4 | 1891 | 54 | pr | 0 | 12 | 0 | 1 | 0 | 77 | 39 |
| VIII | Nashua River, North Branch | 1893 | 13 | 4 | 2 | 42 | 0 | 6 | 0 | 67 | 810 |
| IX | Taunton River | 1891-3 | 17 | 1 | 2 | 13 | 0 | 2 | 0 | 35 | 58 |
| X | Lynde Brook, Worcester | 1891 | 17 | 4 | 3 | 2 | 0 | 1 | 0 | 27 | 68 |
| | NATURAL PONDS. | | | | | | | | | | |
| I | Mystic Lake | 1891-4 | 1917 | 199 | pr. | 18 | pr. | 172 | pr. | 2306 | 128 |
| II | Jamaica Pond | Jan.-Aug. 1891 | 1110 | 103 | 137 | 1 | 1 | 12 | 1 | 1365 | 174 |
| III | Horn Pond, Woburn | 1891-4 | 911 | 302 | 218 | 1 | 1 | 167 | 2 | 1602 | 65 |
| IV | Fresh Pond, Cambridge | 1891-4 | 967 | 95 | 83 | 9 | 1 | 4 | pr. | 1159 | 127 |
| V | Wenham Lake, Salem | 1891-4 | 897 | 38 | 32 | 0 | pr. | 32 | pr. | 999 | 52 |
| VI | Buckmaster Pond, Norwood | 1891-4 | 184 | 83 | 9 | 2 | 1 | 665 | pr. | 944 | 30 |
| VII | Lake Cochituate | 1891-4 | 579 | 33 | 58 | 6 | 2 | 15 | pr. | 693 | 66 |
| VIII | Spot Pond, Malden | 1891-4 | 171 | 85 | 19 | 1 | 1 | 19 | pr. | 296 | 93 |
| IX | Lake Williams, Marlboro | 1891 | 170 | 17 | 66 | 1 | 0 | 14 | 0 | 268 | 67 |
| X | Gates Pond, Hudson | 1891-4 | 110 | 37 | 27 | 1 | 1 | 66 | pr. | 242 | 38 |
| | ARTIFICIAL RESERVOIRS. | | | | | | | | | | |
| I | Haynes Reservoir, Leominster | 1891 | 3193 | 0 | 0 | 1 | 0 | 19 | 1 | 3214 | 155 |
| II | Walden Pond, Lynn | 1891-4 | 254 | 238 | 604 | 8 | pr. | 397 | 1 | 1502 | 64 |
| III | North Reservoir, Winchester | 1891-4 | 1337 | 35 | 72 | 1 | 1 | 149 | pr. | 1596 | 71 |
| IV | Ludlow Reservoir, Springfield | 1891-4 | 504 | 260 | 96 | 5 | 1 | 96 | 2 | 964 | 103 |
| V | Scott Reservoir, Fitchburg | 1892 | 691 | 146 | 10 | 2 | 4 | 92 | 2 | 947 | 42 |
| VI | Holden Reservoir, Worcester | 1891-4 | 646 | 24 | 6 | 1 | pr. | 29 | 1 | 707 | 76 |
| VII | Basin 3, Boston | 1891-4 | 270 | 55 | 23 | 1 | 1 | 12 | pr. | 362 | 122 |
| VIII | Basin 2, Boston | 1891-4 | 99 | 32 | 47 | 5 | pr. | 4 | pr. | 187 | 125 |
| IX | Basin 4, Boston | 1891-4 | 80 | 31 | 3 | 1 | 0 | 5 | 0 | 120 | 43 |
| X | Basin 6, Boston | 1894 | 55 | 5 | 0 | 0 | 1 | 31 | 2 | 94 | 20 |

# NATURAL IMPULSES.

By W. Bernhardt.

There is a mystery existing in nature, inaccessible to human reasoning, as scarcely another one, although the phenomena connected with it are among the best known to us and of daily occurrence. When comparing a grain of mustard seed and one of poppy seed we even with the help of a magnifying glass cannot detect anatomical differences of any concern. Each of them encloses two cotyledons, i. e., the first leaves developing in germination; moreover, it contains a radicle and the beginning of a stem, both located between the cotyledons. Structure and appearance of these primitive organs are very similar in both seeds, and yet what a difference between a grown mustard and a poppy plant! Not only flower and fruit but the whole plant assumes a particular shape and character differing externally as well, as in chemical constituents. We are forced to believe, that the cells, from which both plants originate, are endowed with a disposition forcing the growing organs to assume certain forms in accordance with a certain exchange of matter.

Such a disposition or plan of structure is inherent to every germ of plant and animal. Not the strongest microscope, nor any other means of observation have enabled us to ascertain the matter and processes upon which variation of development depends; only this much has been established, that the faculty is particular to the germ itself, the forms resulting from the growth of a certain kind of germ invariably manifesting the same characters, independent from external influences. Soil, climate and light certainly modify the thriving of a plant, and, when unfavorable, can even prohibit growth, but the plant resulting nevertheless invariably shows the characters of the species to which it belongs. Neither in animal nor in plant, has domestication or horticulture ever generated a new species.

The author by these remarks does not intend to dispute the possibility and even probability, that new species have sprung from former ones in the course of unmeasurable past times; on the contrary, there are numerous geological, botanical and zoological facts known, which irresistibly point in that direction, but in historic time, i. e., during the last 5000 years, no evident change is known to have happened. Plants, animals and people represented on old Egyptian and Assyrian sculptures are exactly the same as those existing nowadays. The time, when linking forms between lizards and birds, as the pterodactylus, were living, lies in a remote past, and the origin of existing transient forms, as ornithorhynchus, lepidosiren and amphioxus may without scruples be dated back to periods preceding the appearance of man. Perfectly agreeing to the view adopted by most naturalists of our time, that plants as well as animals are the results of gradual evolution originating from monocellular organisms, we find it supported by the convincing argument of the descent of every single being from a minute fertilized cell, the embryo of man itself in its first stages closely resembling those of other animals, differences in the accomplishment of organs appearing in the advanced periods of growth.

By the comparison of any forms of higher animals including insects, evidence is given of a principle or type of symmetric structure common to all of them. There is a head provided with partly bilateral organs for the reception of objects and impressions from the outside and ending in a chord of nervous substance, the spine, located on the back or front side of the body, and dividing it into two longitudinal halves, to which the organs of movement are attached equally distributed on both sides, one side being the reverse of the other one. Similar pervading principles of structure are found in lower animals, more or less varying according to the classes and families to which the beings belong. The structural principles pervading the vegetable world are different, but not less evident and striking ones. One of the chief features in higher plants is the constant repetition of the same number, or a multiple of it in the parts of the flower and the fruit. In many families

the number 5 is the predominating one, in others 6, or another amount in the parts of the calyx as well, as in the petala, stamina, stigmata and carpella. Perfect symmetry in the arrangement and division of organs also is frequently found in plants and beautifully exhibited in many forms of ferns.

Pursuing the enforcing faculty, the impulse or will in animals or plants to conduct the formation of organs in certain unvariable ways, independent from external influences, we find it concealed in the minute embryo from which all creatures originate. But we have to admit at the same time, that the researches hitherto performed on this subject were but little successful, inasmuch as our knowleege in this respect is not much beyond that of our predecessors a century ago. They knew as well as we, that it is the germ or embryo, which is endowed with this power. The only apparent progress made is a hypothetical one, and consists in the prevailing opinion that in germination and growing, two different kinds of cells are active, some of them, the vegetative cells, being chiefly engaged in nutrition and growth, the others, or reproducing cells, for transferring to young individuals and preserving the character of the parents, family, tribe, etc. It is upon the presence of this last kind of cells—most frequent in reproductive organs—that the resemblance in members of families and nations and of genera and classes is believed to depend. Scientists attribute the reproductive faculty to the nucleus of protoplasma or albuminous matter found in these cells.

The growth of cells is a limited one. When a certain store of food has been taken up and a certain amount of protoplasma has been formed, the latter, forming the kernel or nucleus of the cell, receives a gradually increasing stricture, dividing it into two halves, which finally separate; the stricture extends to the whole cell, which by division gives rise to two new cells perfectly resembling the mother cell as to form, organization and general characters. In this way multiplication of all reproducing cells takes place, including that of micro-organisms; it is the simplest and primitive way of generation of new individuals. We see, that the progress of our knowledge in this question is limited to the fact, that while formerly the embryo

as a whole was regarded as the agent at once reproducing and preserving the original form, these functions nowadays are attributed to a certain class of its constituting cells, or rather to the protoplasma which they contain.

But a scanty comfort it is, that this theory affords to our mind eager to penetrate into this apparently unfathomable secret of nature, intimately connected with the question for the origin of life itself; but notwithstanding its deficiencies, the hypothesis of reproducing cells well explains the resemblance commonly existing between members of one family, its increasing in nearly related individuals and its diminishing by the interference of strange elements.

If permitted to consider the " cell " as the elementary organ in animals and vegetables, we are as well justified to attribute the same roll in the mineral world to the " crystal." There is no mineral substance existing which is not known to crystallize under certain circumstances, and the formation of cells in plants from the constituents of their juices, the secretion of muscular fibre from albuminous matter in blood, stands in closer relation to the separation of crystals from solutions, than is generally imagined. Who, when on a cold winter morning, finding the panes of his windows covered with ice-crystals shaped like luxurious ferns, mosses or twigs of pine trees, was not impressed with the conjecture of a relation between the phenomena of organization and crystallization of some common occult force giving form to organic as well as to nonorganic matter? Indeed, there are no strict limits existing between organization and crystallization. The curved line and surface may be regarded as particular to and characteristic of organic matter, the straight line and surface of mineral substances, but there are innumerable exceptions exhibiting the former in well defined crystals, while crystals of minerals frequently occur having curved surfaces. Thus the crystals of pyromorphite, chiefly consisting of phosphate of lead, are polyhedra with curved planes, and compounds of hydroxylamine with certain oxides of metals have hemispheric forms. The starch grain may be considered as the connecting link between both morphological classes, the round form on the one hand

indicating a cell like character, its growing by attachment of layers on its outside on the other hand, perfectly agreeing with the way in which crystals are observed to grow.

It is in three states that solid matter is known to occur, in the amorphous, the crystalline and the organized states. The amorphous seems to be the original one, since the others are generally found to originate from it, the reverse but exceptionally taking place. The best known amorphous substance is glass, in which in its perfect state no crystalline particles can be discovered. Resins, such as colophony and copal, and Indian rubber are amorphous, as well as glue and molten sugar in its fresh state. In sugar the liability to pass into the crystalline state is very prominent; sometimes a few minutes after its cooling the transparent mass becomes opaque by the separation of minute crystals of sugar. Crystallization frequently sets in in some varieties of glass, particularly when rapidly cooled. Albumen is the principal amorphous substance in living animals from which organized matter is derived.

A striking difference of amorphous and crystalline matter is manifested in the behavior of their solutions. Amorphous matter soluble in water, when dissolved gives viscid or gelatinous liquids, their thickness increasing with the lessening amount of water present. No compounds with water in definite proportions seem to be existing. Solutions of crystalline matter, on the contrary, are thin as water; when concentrated to a certain point crystals of solid matter begin to separate. Crystallization sometimes sets in suddenly, the whole liquid turning into a magma of small solid particles suspended in the fluid. The solution contains compounds with water in definite proportions. When evaporating a solution of red cobalt chloride, it suddenly turns blue, which happens in the moment when more water has been removed, than the red salt needs for its existence.

Having tried to explain the resemblance in the features of related organisms by the prevailing of particular cells reproducing by unknown impulses the same character in every new individual, we feel induced to look for the cause of the well

known fact, that mineral matter is subject to similar constraints, being forced, when crystallizing, to assume certain invariable forms. Every crystalline body has its peculiar shape varying only by the addition of planes belonging to forms of the same system. Compounds of different ingredients, but of similar constitution, are frequently found to appear in the same forms, as is seen in the class of compounds comprised by the name of "alum." Whenever a body is found crystallizing in several systems, a chemical difference, although perhaps a slight one, may generally be assumed. But in identical bodies polymerisation, or multiplication of atoms in a molecule, is a frequent cause of variations in form. It is one of the merits of the new doctrine of stereo-chemistry to have given the hint, that molecules of compounds as well as of elementary bodies, contain their atoms arranged in certain directions given by the prevailing chemical attractions. In accordance with this view every molecule may be represented by a certain stereometric form, be it a tetrahedron, an octahedron, a cube, etc. The attractions diverting accumulation of atoms in a molecule also govern the attractions uniting the molecules to visible crystalline individuals. The effects of such attractions are even frequently extended to the position of the crystals to each other. Every snow flake represents a system of symmetrically arranged numerous hexagonal ice crystals, the hexagonal form not only dominating in the single crystals, but being evidently noticeable in the whole beautiful arrangement. Common salt, when crystallizing from saturated solutions, is seen to separate in amphitheatrical square combinations consisting of single cubical salt particles. In the single crystals, as well as in their congregations, we observed the square predominating as the elementary form.

Neither in the manifold features of animal and plant life, nor in the crystalline formations of mineral matter, are external influences deciding as to the forms to be adopted. Individuals of different natural character of different species, grow up and become differently shaped, although exposed to the same external conditions. A slight transforming influence of temperature, light, food and contact cannot be denied, but the

preservation of existing types of species and genera in all three natural worlds is the effect of unknown forces independently acting in reproductive cells and organs, as well as in mineral atoms and molecules. If we may expect ever to notice the formation of a new species under our eyes, this event will not depend upon external conditions, but upon a change in the nature of protoplasma, or of the chemical structure of a mineral molecule. The author does not doubt that such changes are continually going on in nature, but they are too slow and subtile to be accessible to our observation. The chief part in such changes will always be due to agents or forces peculiar to the elementary organs and exerting impulses, by which permanent forms are resulting.

## CONTRIBUTIONS TO COCCIDOLOGY.—II.

By T. D. A. Cockerell, Mesilla, New Mexico.

No. I appeared in American Naturalist, Aug., 1895, pp. 725–732.

(1). *Icerya rileyi* Ckll. In September, 1893, I bred a *Lætilia* from a larva living on *I. rileyi* on mesquite at Las Cruces, N. M. The Rev. G. D. Hulst informed me that it was "different from *coccidivora* and from *L. ephestiella*, a good variety at least." It may, therefore, be as well to put its characters on record:—

*Lætilia coccidivora* var. *hulstii*, n. var.—Palpi ascending; fore wings gray, brownish at extreme base and beyond the first band. The first band, at end of basal third, double, consisting of a gray line bordered without by a white band. A wavy band consisting of two blackish lines not far from the exterior margin. Hind wings shining white; abdomen above whitish, banded with gray. It would seem to connect *coccidivora* with *ephestiella*, and so, perhaps, all are varieties of one.

(2). *Rhizococcus* (?) *devoniensis* Green, Ent. Record, 1896, p. 260. I should certainly prefer to call this *Eriococcus devonien-*

*sis.* We know already several species of *Eriococcus* with 7-jointed antennæ; the subgeneric name *Thekes* Crawford ms., is available for them.

(3). *Phenacoccus comari* (Kunow). *Coccus comari* Kunow, Ent. Nachr., 1880. Near Königsberg. See also Douglas, Ent. Mo. Mag., xvii, p. 90. The description appears to indicate a *Phenacoccus*, but it is very short.

(4). *Dactylopius edgeworthiæ*, n. sp.—♀ about or hardly 2 mm. long, pale gray, with light brown legs and antennæ. Form oval, back so thickly dusted with white meal as to appear white with a grayish tint; no distinct lateral or caudal appendages; extremely short, hardly noticeable thick caudal tufts. The white secretion on the back forms three more or less distinct longitudinal rows of small protuberances, giving the insect an obscurely tricarinate appearance. Immature ♀ similar, but not so mealy.

♀ boiled in KHO turns very dark lake-red, but does not stain the liquid. Antennæ 7-jointed, formula 7 (32) (41) 65. 3 is perhaps a *little* longer than 2; 7 is considerably longer than 5+6; 5 is very little shorter than 6; 4 is conspicuously shorter than 2 or 3. Legs ordinary, femur quite stout, its upper edge convex; tibia a little shorter than femur, stout; tarsus a little shorter than tibia. Claw moderate, with a minute denticle on its inner side. Digitules of claw slender, somewhat curved, extending a little beyond tip of claw, with fairly distinct knobs; no tarsal digitules. Anal ring with the usual six bristles. Caudal tubercles very low, ordinary, each with a large bristle, some short ones, round glands and a pair of conical spines. The insect throughout is very little hairy. The skin exhibits numerous gland-dots.

♂ sac ordinary; a ♂ with wings expanded taken from a sac. Length of body about 1⅗ mm.; head to tip of wing about 2 mm. Wings white, the nervures very distinct, costa not at all darkened. Antennæ pale ochreous, head pale olivaceous, prothorax dark slate gray,

mesothorax pale ochreous, strongly contrasting. Abdomen dark olivaceous, legs white, with a yellow tinge. The pale ochreous color of the middle of the thorax is continued beneath, contrasting with the parts before and behind; eyes red. ♂ hatching at the end of March.

*Hab.*—Japan, on stems of *Edgeworthia papyrifera;* found by Mr. Alex. Craw in the course of his horticultural quarantine work. While the antennæ are but 7-jointed, the legs are those of a *Phenacoccus.*

(5). *Erium,* Crawford, ms. This name will stand for the subgenus of *Dactylopius* without lateral cottony tufts, forming complete separate cottony sacs. The type is *D. globosus* Maskell. The species are found in America, the Sandwich Islands, New Zealand, Australia and S. Africa.

(6). *Asterolecanium bambusæ* var. *bambusulæ,* v. nov.—♀ scale elongate-oval, 2 mm. long, 1 broad, dullish, not at all keeled, barely narrower behind than in front, where it is broadly rounded. Color very pale sulphur-yellow, dark at one end from the body of the ♀ showing through. Fringe short, pinkish, the pairs of rods mostly diverging at tips. ♀ turns in orange in KHO. Part of margin with a single row of glands, in pairs, but not actually touching, all very close together; and part with in addition a row of very small single glands, about three to each two pairs of the larger paired glands. Scattered glands elsewhere, not numerous.

*Hab.*—On stems $1\frac{3}{4}$ mm. diam. of a small cultivated bamboo. Botanic Gardens, Grenada, West Indies, collected by Mr. W. E. Broadway, Nov. 16, 1895. One specimen is attacked by a dark brown fungus.

(7). *Pulvinaria simulans* Ckll.—Monterey, Mexico (C. H. T. Townsend). New to Mexico. Antennæ 7-jointed.

(8). *Lecanium ceratoniæ* Gennadios, 1895.—Found in Cyprus. The few words of description indicate *L. hesperidum,* to which this species must be referred, unless its author can show some reason to the contrary.

(9). *Lecanim flaveolum* Ckll.—From the original type lot I bred *Coccophagus flavoscutellum*, Ashm., identified for me through Mr. Marlatt.

(10). *Lecanium persicæ* (Fab.).—Montrose, Colo., sent by Prof. Gillette. New to Colorado. The material is poor, but I think my identification is correct.

(11). *Lecanium quadrifasciatum* Ckll.—The newly hatched larva is dark gray with a pale margin, and two longitudinal dark, dull pink bands. The larger stigmatal spines are quite large and stout, blunt, but not so long as the third joint of antenna, and so nothing to compare with those of *mirabile*. The species has never been found except at the type locality in the Organ Mts., N. M.

(12). *Physokermes insignicola* (Craw).—Mr. Alex. Craw kindly sent me ♂ scales of this. No ♀ scales came with them, so the determination rests with Mr. Craw. The males hatched at the end of March. Alive, they are black, or so dark brown as to seem so. Legs and antennæ brown, rather pale, especially the antennæ. The two white caudal filaments very long, nearly twice as long as body. Wings broad, reddish-hyaline, little colored, with a broad, very distinct pink subcostal stripe. Other particulars concerning this male have been given by Miss Tyrrell, and need not be repeated.

(13). *Pseudoparlatoria parlatorioides* (Comst.) and *Aspidiotus personatus* Comst., were both found by Mr. Alex. Craw on leaves of a cocoanut palm from Acapulco, Mexico. Both are new to Mexico.

(14). *Parlatoria theæ* var. *euonymi* Ckll., n. var.—♀ scale circular to oval, dark brown; exuviæ greenish-black; second skin circular, with an extremely narrow but well defined ochreous margin, hardly projecting beyond scale; first skin only slightly projecting beyond second. Scales removed from twig leave an obscure whitish mark. ♀ boiled in KHO turns green. Three pairs of distinct pale brownish lobes. Lateral groups of glands well apart, as in *theæ*. Plates between

median lobes as in *viridis*; lobes and other plates as in *theæ* very nearly. The following table of the grouped ventral glands in *Parlatoria* may be useful:—

| | *euonymi* | *theæ* | *viridis* | *calianthina* | *pergandii* |
|---|---|---|---|---|---|
| caudolaterals, | 12–18 | 7 | 16–17 | 19 | 4–10 |
| cephalolaterals, | 21–23 | 20 | 9–16 | 16 | 4–10 |
| median. | none | 1 | 1–4 | 4 | none |

In *P. calianthina* Berlese, the median lobes are only notched without; in *euonymi* they are very strongly and about equally notched on each side, and *pergandii* has them nearly the same.

(15). *Aspidiotus juglans-regiæ* v. *albus* Ckll.—In fair quantity on an osage orange bush (*Maclura*) in Mesilla, March, 1897. Some showed parasite holes. The food plant is new.

(16). *Chionaspis citri* Comst.—On oranges from Samoa; found by Mr. Craw. A new locality, until reported last year by Mr. Craw. It was earlier known from Tonga.

(17). *Chionaspis braziliensis* Sign.—On a fern (seems to be a *Polypodium*) in a California green-house, largely parasitized; mostly ♂ scales. Sent by Mr. Craw. A new locality. It is probable that *brazilensis, aspidistræ* and *latus* are varieties of one species. These, with *C. minor*, form a distinct subgenus, in which the females resemble *Pinnaspis*, while the ♂ scales are those of *Chionaspis*. It may be termed *Hemichionaspis*, with *C. aspidistræ* as the type.

## THE SEVENTH SESSION OF THE INTERNATIONAL GEOLOGICAL CONGRESS.

(4th Circular).

Russia, 1897.

As we have had the honor of announcing in our third circular addressed to all the members of the Congress, the number of participants in the excursions of the Ural, of Esthonia, and of the Volga has been necessarily limited. The committee of organization has found itself obliged to adopt this measure as

much in consequence of the inadequate number of hotels as because of the necessity of having recourse to private houses for lodgings, or having to offer nothing but the cars for passing the night. This applies especially to the Urals where there will be great distances to be traversed in carriages in a region little populated and where the mining establishments have but few carriages to put at the disposition of excursionists. The participants in the excursion to the Ural will do well to take with them a pillow, a wrap (plaid), warm clothing, good boots, and an impermeable overcoat.

Actually the number of geologists desirous of taking part in these excursions considerably exceeds the number to which we must limit ourselves. The committee of organization finds itself in consequence, very much to its regret, in the sad necessity of not being able to admit all the requests, and (in the impossibility of satisfying every body) of giving preference to the persons who were the first to present themselves in answering the first circular of last year as well as the second.

The persons to whom participation in these excursions must be refused are notified of the fact by a special letter.

In order to avoid that geologists who have inscribed themselves conditionally for this or that excursion and who wish to abandon it, should deprive their fellow geologists of the possibility of taking part, the committee of organization begs them to notify it definitely whether or not they maintain their wish to participate in the excursions to be made before the Congress (to the Ural or to Esthonia).

From the 15 (27th) to the 18th (30th) of July delegates of the committee will be stationed at the Stations in Moscow of the Moscow-Brest, and Nicholas railways, to direct geologists coming from foreign countries to the place of meeting of the excursionists going to the Ural.

In sending the ticket giving the right to transportation in the first class on the Russian railways, the committee of organization permits itself to remind the geologists that the gratuitous tickets for the Russian railways will be good from the 10th (22d) of July to the 5th (17th) of October.

These tickets give the right to go from the frontier to the starting places of the excursions (St. Petersburg, Moscow, etc.), and to take part in all the parts of the proposed itinerary.

Similarly the tickets will be good for the return of the excursionists to the frontier starting from any point where they wish to leave the excursions of the Congress.

Conformably to the laws in force on the Russian railways the holder of gratuitous tickets are required:

1. Not to transfer them to other persons.
2. To present the ticket on request of the conductor of the train or of the management.
3. Each ticket gives the right to the gratuitous transportation of 1 pound (16 kilograms).

The committee of organization begs each possessor of a ticket, to sign it himself on the back near the bottom, at the line marked by a red point.

Persons who do not make use of the railway ticket sent them, are requested to return it to the committee by registered letter.

To the persons arriving by Finland, the tickets for transportation on the Finnish railways will be delivered by Mr. I. Sedorholm, Director of the Geological Survey of Finland, and member of the Committee of organization.

In the name of the general committee of organization.

THE BUREAU.
A. KARPINSKY, *President.*
TH. TSCHERNISCHEW, *General Secretary.*

## RECENT LITERATURE.

**A Text-Book of Experimental Embryology.**[1]—Professor Morgan, of Bryn Mawr College, has made the first attempt to bring the results of the labors of German and American experimental embryologists into such form as may serve as an introduction to this rapidly growing branch of biology. The scattered and too often inaccessible

[1] The Development of the Frog's Egg. An Introduction to Experimental Embryology, by Thomas Hunt Morgan. The MacMillan Co., New York, 1897, pps. 186, 51 figs. in text. Price, $1.60.

notes and papers put forth by the enthusiasm of workers in this field are here brought to the hands of the student in a form at once intelligible and available; grouped about a concrete case, the development of a well known animal, the frog. But the book is less a compilation than the entire statement of the author's own researches on this subject complimented and illuminated by facts taken from other authors, having a direct bearing upon the frog's development, though sometimes going into wider fields for more definite illustration. It is an account of the development of the frog as seen from the point of view of the experimental embryologist, who desires to understand as well as to record his facts, and seeks information by direct, more or less pertinent, questions put to nature in the form of experiments. With the exception of certain treatises upon comparative embryology, we may regard this as the first attempt at a truly scientific text-book of embryology—as something more than a history of developmental stages—and it is noteworthy that America and not Germany has produced this as well as the two other important biological text-books recently issued by the same publishers.

The book will serve as a useful manual for advanced students and welcome reading for the many biologists who have not the time for direct study in this special field. How far it may lead to the gradual substitution of the life history of the physiologist's pet, the frog, in place of the development of the ever accessible chick in elementary biological instruction remains for time to show.

A brief summary of the leading chapters may convey some idea of the ground covered and the treatment of the subject. The first deals with the making of the egg and sperm, and is largely a compilation with free use of phenomena better known in other animals. The second describes the formation of the polar bodies and the process of fertilization. The third briefly reviews experiments upon cross-fertilization in frogs of different species. The fourth treats of cleavage and shows the author's special intimacy with this phase of the subject; there is not only a detailed description with excellent original figures, but also a most interesting comparison of the arrangements of cells in the cleaving of frog's eggs with possible combinations of oil drops as arranged in Roux's experiments. The author says: "It seems highly probable that surface tension is also an important factor in the segmenting egg, but other conditions present prevent its free play."

The fifth and sixth take up in detail the formation of the blastopore and the associated phenomena of concrescence and germ-layer formation; intricate problems clearly elucidated in the frog's case by aid of

the author's own research. Additional evidence is presented in the next chapter which considers the abnormal embryos made in salt solutions in the experiments of Hertwig and of Morgan.

Two chapters discuss the effects of gravitation acting upon cleaving frog's eggs; first in the series of experiments of Pflüger and then in those of Born and of Roux. The tenth takes up the cleavage of eggs under pressure and concludes that in early cleavage the *nuclei are all equivalent.* The next throws additional light upon the nature of cleavage in presenting the work of Roux, Morgan and others, who have reared larvæ from eggs in which one of the first two cells has been injured. The intricacies of "post generation" are also set forth here.

The interpretations and conclusions of the twelfth chapter conclude that part of the volume dealing with experimental work, save that a short sixteenth chapter briefly gives the effect upon frog's eggs of light and of temperature.

Two added chapters continue the account of the frog's growth, and describe the formation of mesodermal and of entodermal organs, so that the book may serve as a substitute for Marshall's text-book, besides being an introduction to a new method of study.

In the twelfth chapter we find a very clear statement of Roux's mosaic theory and its modifications, a brief account of the conceptions of Driesch and of Hertwig, and the remarkable facts observed upon the Ctenophore egg. From experiments upon these eggs the author concludes that "in the protoplasm and not in the nucleus lies the differentiating power of the early stages of development."

The Roux-Weismann hypothesis of *qualitative* nuclear division is rejected as having "no known histological facts in its favor."

To reconcile the prevailing conception of the power of the nucleus with the idea that the differentiating power resides in the egg protoplasm outside the nucleus, the author suggests that the nucleus participates in determining form only so far as it controls the special character of an organ, while the main determination as to what part shall be one organ rather than another, is made by the non-nuclear part of the egg or cell. "After cleavage, the cytoplasm of each part differentiates into this or that organ, but the kind of differentiation of each part is determined by the nucleus of that part."

Touching the fundamental question as to the cause of differentiation the author says: "Driesch has pointed out that the egg seems to act like an intelligent being." If so, are the causes of differentiation and of regeneration the same in kind as physico-chemical causes, or do they belong to the category of intelligent acts, and can these latter be ac-

counted for by *known* principles of chemistry and physics? The plain answer is, we do not know.—E. A. A.

**Miocene Mollusca and Crustacea of New Jersey.**[2]—This important work is published in the Monograph (Vol. XXIV) Series of the U. S. Geological Survey. Very little attention had been given to the Miocene molluscan fauna of New Jersey when Mr. Whitfield began a systematic study of it. A list published by Mr. F. B. Meek, a few species described by different writers, and the work done by Prof. Heilprin summarizes all the knowledge concerning this fauna up to 1887. The present work is based on the collections in the U. S. National Museum and the Philadelphia Academy of Natural Sciences. One hundred and four species are recognized and described, which, with the four species given in Prof. Heilprin's list and two species of Bryozoans in Meek's list would carry the number to one hundred and ten species. The species described are distributed as follows: Brachiopoda 1, Lamellibranchiata 61, Gasteropoda 39, Crustacea 1. All the species are figured on 24 page-plates.

**Sixteenth Annual Report U. S. Geological Survey, Parts III and IV.**[3]—This report forms the eleventh in the series Mineral Resources of the United States. Part III treats of metallic products containing the usual summary of recent developments in the knowledge of the mineral deposits, the amount produced, its value, etc. in this country, etc. and also in other countries which trade with the United States. Part IV embodies the latest information concerning the non-metallic products. The illustrations consist of maps, diagrams and figures in the text.

We are informed that the cost of printing and binding is no longer charged for this book, and that by making prompt application to a Senator or Representative the volume may be obtained, as the Congressional distribution of the book will soon ensue.

**Glaciers of North America.**[4]—In an octavo volume of some 210 pages Mr. Russell has condensed the existing knowledge of North

[2] Monographs of the U. S. Geological Survey. Vol. XXIV. Miocene Mollusca and Crustacea of New Jersey. By R. P. Whitfield. Washington, 1894.

[3] Sixteenth Annual Report of the United States Geological Survey. Part III, Mineral Resources of the United States, 1894, Metallic Products. Part IV Non-metallic Products. Washington, 1895.

[4] Glaciers of North America. By I. C. Russell. Boston and London, 1897. Ginn and Co., Pub.

American glaciers, besides giving brief descriptions of glacial phenomena in general. The closing chapter presents a view of the life history of an alpine glacier, of which representatives occur in abundance and in great variety in North America. The author instances the Seward glacier, Alaska, as the largest of this type that has ever been discovered. The Malaspina glacier, the great ice sheet which intervenes between Mt. St. Elias and the Pacific, represents a second or Piedmont type, and the still larger, or Continental glacier, is typified by a single example in Greenland.

The work is abundantly illustrated by maps, page plate pictures reproduced from photographs, and cuts in the text.

## AMERICAN NATURALIST LIST OF RECENT BOOKS AND PAMPHLETS.

ALLEN, J. A.—Descriptions of New North American Mammals.

——On some Mammals from the Santa Cruz Mountains, California.

——List of Mammals collected by Mr. W. W. Granger in New Mexico, Utah, Wyoming and Nebraska, 1895–96, with Field Notes by the Collector. Extrs. Bull. Amer. Mus. Nat. Hist., 1896. From the author.

BALINOKAND.—The Priceless Gem. Sahore, 1896. From the author.

BANGS, O.—An Important Addition to the Fauna of Massachusetts. Extr. Proceeds. Boston Soc. Nat. Hist., Vol. 27, 1896. From the author.

BAR, M.—Beiträge zur Kenntnis der Anatomie und Physiologie der Athemwerkzenge bei den Vögeln. Aus Tübinger Zool. Arbt., 1896. From the author.

BATCHELDER, C. F.—Some Facts in Regard to the Distribution of Certain Mammals in New England and Northern New York. Extr. Proceeds. Boston Soc. Nat. Hist., Vol. 27, 1896.

——An Undescribed Shrew of the Genus Sorex. Proceeds. Biol. Soc. Washington, Vol. X, 1896. From the author.

BREWER, WM. M.—A Preliminary Report on the Mineral Resources of the Upper Gold Belt. Bull. No. 5, 1896, Geol. Surv. Alabama. From the Survey.

Bronn's Klassen und Ordnungen des Thier-Reichs, Vierter Bd. Vermes. Leipzig, 1896 u 1897. Sechster Bd. Mammalia. Leipzig, 1897.

CARLISLE, J. G.—Letter transmitting, in response to the House Resolution of the 22d instant, a copy of the Report of Henry W. Elliott on the Condition of the Fur Seal Fisheries of Alaska. Washington, 1896.

CASSINO, S. E.—The International Scientists' Directory. Boston, 1896. From the author.

CATTANEO, G.—Le Gobbe e le Callosita dei Cammelli in rapporta all questione dell'erenitarietà dei caratteri acquisiti. Estr. Rendicanti R. 1st Lomb. di sc. et lett. Ser. II, XXIX, 1896. From the author.

CHUDZINSKI, TH.—Quelques observations sur les Muscles Peauciers du Crane et de la Face dans les Races humaines. Paris, 1896. From the author.

CORNISH, C. J.—Animals at Work and at Play. New York, 1896. From John Wanamaker.

DITMARS, R. L.—The Snakes found within fifty miles of New York City. Abstr. Proceeds. Linn. Soc. New York, 1896. From the author.

DUMERIL, A. ET F. BOCOURT.—Etudes sur les Reptiles et les Batraciens, Pt. III. Miss. Sci. au Mexico et dans l'Amerique Centrale, 1895. From the authors.

DYAR, H. G.—On the Larvæ of the Higher Bombyces (*Agrotides grote*). Extr. Proceeds. Boston Soc. Nat. Hist From the Society.

FLETCHER, A. C.—Address before the Section of Anthropology, Amer. Assoc. Adv. Sci., 1896. Extr. Proceeds. A. A. A. S., 1896. From the author.

GILL, TH.—On the Nomenclature of Rachicentron or Elacate, a Genus of Acanthoplerygian Fishes. (No reference given.)

GREEN, I. M.—The Peritoneal Epithelium of some Ithaca Amphibia. Extr. Trans. Nineteenth Ann. Meet. Amer. Micros. Soc., 1896.

HAECKEL, E.—Systematische Phylogenie der Wirbellosen Thiere (Invertebrata) Zweiter Theil. Berlin, 1896. From the author.

Hatch Experiment Station, Mass. Agri. College Bulletins No. 41, 1896. From the Station.

HESSE, R.—Die Organe der Lichtempfindung dei den Lumbriciden. Extr. Tübinger Zool. Arbeit., II, Bd. No. 2, 1896.

HOWE, L.—Art and Eyesight. Extr. Appleton's Pop. Sci. Monthly, Aug., 1895. From the author.

ILES, G.—The Appraisal of Literature. Address before the Amer. Library Assoc., 1896. From the author.

KELLOGG, V. L —New Mallophaga from Land Birds, together with an Account of the Mallophagous Mouth parts. Contrib. to Biol. from the Hopkins Seaside Laboratory, VII. Palo Alto, 1896. From the author.

KEYES, C. R.—Review of Zittel's Text-Book of Paleontology. Vol. I, Pt. 1. Extr. Journ. Geol., Nov., 1896. From the author.

LAZENBY, W. R.—Address before Section I, Amer. Assoc. Adv. Sci., 1896. Extr. Proceeds. A. A. A. S., 1896. From the author.

LINTNER, J. A.—Report of the State Entomologist for the year 1893. Albany, 1894. From the author.

MARVIN, F. O.—Address before Section D, Amer. Asso. Adv. Sci., 1896. Extr. Proceeds. A. A. A. S , 1896. From the author.

MILES, M.—Relative Efficiency of Animals as Machines. Extr. Amer. Nat., 1896. From the author.

MILLER, G. I., JR.—The Beach Mouse of Muskeget Island. Extr. Proceeds. Boston Soc. Nat. Hist., Vol. 27, 1896. From the author.

MILLER, S. A. AND WM. F. E. GURLEY.—New Species of Crinoids from Illinois and other States. Bull. No. 9, Ill. State Mus. Nat. Hist., 1896.

MITSUKURI, K.—On the Fate of the Blastopore, the Relations of the Primitive Streak, and the Formation of the Posterior end of the Embryo in Chelonia, together with Remarks on the Nature of Meroblastic Ova in Vertebrates. Reprint Journ. Coll. Sci. Imp. Univ., Tokyō, Vol. X, Pt. I, 1896. From the author.

MORLEY, E. W.—Addresss before the Amer. Asso. Adv. of Sci., 1896. Extr. Proceeds. Amer. Assoc. Adv. Sci., 1896. From the author.

NEWELL, F. H.—Report of Progress of the Division of Hydrography for the Calendar Years 1893 and 1894. Bull. No. 131, U. S. Geol. Surv., Washington, 1895. From the Survey.

PERACCA, M. G.—Rettili ed Anfibi raccolti à Kanzungula a sulla strada da Kazungula à Buluwaio, dal Rev. Luigi Jalla Missionario Valdese nell'alto Zambese. Extr. Boll. Mus. di Zool. ed Anat. Comp. R. Univ., Torino, Vol, XI, 1896. From the author.

PHILLIPS, W. B.—Iron Making in Alabama. Bulletin Alabama Geol. Surv., 1896. From the Survey.

SMITH, H. I.—Certain Shamanistic Ceremonies among the Ojibwas. Extr. Amer. Antiq., Sept., 1896.

TRELEASE, WM.—Botanical Opportunity, Address before the Bot. Soc. Amer., 1896. Extr. Bot. Gaz., Vol. XXII, 1896.

Washington Philosophical Society Bulletin, Vol. XII, 1892-94. Washington, 1895. From the Society.

WERNER, F.—Beiträge zur Kenntniss der Reptilien und Batrachier von Centralamerika und Chile, sowie einiger seltenerer Schlangenarten. Aus Verhandl. k. k. zool.-bot. Gesell. Wien, 1896. From the author.

WICKSON, E. J.—Dairying in California. Bull. No. 14, 1896, U. S. Dept. Agric. Bur. An. Indus. From the Dept.

WOODWARD, A. S.—Note on a Supposed Tooth of Galeocerdo from the English Chalk.

——On the Deep-bodied Species of the Clupeoid Genus Diplomystus.

——On the Devonian Ichthyodornlite, Byssacanthus. Extrs. Ann. Mag. Nat. Hist. (6), XV, 1895.

——On some Remains of the Pycnodont Fish, Mesturus, discovered by A. N. Leeds, Esq., in the Oxford Clay of Peterborough. Extr. Ann. Mag. Nat. Hist. (6), XVII, 1896. From the author.

# General Notes.

## MINERALOGY AND CRYSTALLOGRAPHY.[1]

**Lewisite and Zirkelite.**—Hussak and Prior[2] have given these names to two new Brazilian minerals. The lewisite, named in honor of Prof. W. J. Lewis, of Cambridge, Eng., was obtained from the cinnabar mine of Tripuhy in the gravel occurring on a hill-slope near Ouro Preto, Minas Geraes, Brazil. Xenotime, cinnabar, monazite, zircon, kyanite, tourmaline, rutile, hematite, pyrite, magnetite, gold, lewisite and a new titano-antimonate of iron, not yet obtained in quantity sufficient for accurate determination, constitute the heavy sand obtained by washing the gravel with a "batea." Lewisite occurs in perfect honey-yellow to brown octahedra, seldom exceeding 1 mm. in diameter. Twinning on the plane 111 is rare. Translucent, isotropic, streak light yellow-brown, cleavage octahedral, hardness 5.5, lustre vitreous to resinous, specific gravity 4.95. A pulverulent sulphur-yellow decomposition product was sometimes observed on the surface and in cavities inside the crystals. The results of an analysis and the theoretical composition of 5 CaO, 3 $Sb_2O_5$, 2 $TiO_2$ are given as follows:

| | | |
|---|---|---|
| $Sb_2O_5$ | 67.52 | 68.42 |
| $TiO_2$ | 11.35 | 11.70 |
| CaO | 15.93 | 19.88 |
| FeO | 4.55 | |
| MnO | .38 | |
| $Na_2O$ | .99 | |
| | 100.72 | 100.00 |

The lewisite is thus most closely related to Mauzeliite, an isometric mineral described by Sjögren (Geol. Fören. Förhand. Stockholm, XVII, pp. 313–318, 1895). Mauzeliite is brown, with Sp. G. 5.11, and gave, on analysis, $Sb_2O_5$ 59.25, $TiO_2$ 7.93, PbO 6.79, FeO .79, MnO 1.27, CaO 17.97, MgO .11, $K_2O$ .22, $Na_2O$ .27, $H_2O$ .87 and F 3.63 (by difference?). The Swedish mineral contains much more lead and fluorine and less iron than that from Brazil.

The name zirkelite is given to a black, isometric, nearly opaque titano-zirconate of calcium and iron which occurs in the form of octa-

[1] Edited by Prof. A. C. Gill, Cornell University, Ithaca, N. Y.

[2] Min. Mag., Vol. XI, Sept., 1895, pp. 80-88.

hedra with baddeleyite, perofskite, etc., in the decomposed magnetite-pyroxenite of Jacupiranga, Sao Paulo, Brazil. Its density is 4.706, its hardness 5.5, and an analysis gave $ZrO_2+TiO_2$ 79.79 (48.90+30.89?), FeO 6.64, CaO 11.61, MgO .49, loss on ignition 1.02, total 99.55. Note of this mineral without proposal of a name was earlier made by Hussak in Tschermak's Min. Pet. Mitth., XIV, pp. 408–410.

**Epidote and Zoisite.**—In connection with a somewhat detailed study of four alpine occurrences of epidote and zoisite, Weinschenk[3] proposes the name *clinozoisite* for those monoclinic members of the zoisite-epidote group which approach zoisite in chemical composition, are optically positive, and have a less index of refraction and a less double refraction than ordinary epidote. A beautifnl new occurrence of clinozoisite at the Goslerwand in the Tyrol furnishes crystals of a delicate rose-red color. Their crystal form coincides with that of epidote. An analysis gave:—

| | |
|---|---|
| $SiO_2$ | 39.06 |
| $Al_2O_3$ | 32.57 |
| $Fe_2O_3$ | 1.68 |
| FeO | .29 |
| MnO | trace |
| CaO | 24.53 |
| $H_2O$ | 2.01 |
| | 100.14 |

The indices of refraction are $\alpha=1.7176$, $\beta=1.7195$, and $\gamma=1.7232$. Hence the double refraction $\gamma-\alpha=.0056$, which is the lowest value ever recorded for a monoclinic epidote. The optical angle is:— $2V_{Li}=80° 50'$, $2V_{Na}=81° 40'$, and $2V_{Tl}=$ about 83°. Sp. G. 3.372.

**The Monoclinic Pyroxenes of New York State.**—These, with the exception of wollastonite, are quite fully discussed by Ries,[4] who gives also an extended bibliography of the subject. The aluminous augites of New York show more frequently an exception than an agreement with Tschermak's suggestion that Ca is less than Mg+Fe. Most of the large mineral collections which were likely to contain much material from New York were consulted in the course of these studies, so that the list of localities is doubtless very complete.

[3] Zeitsch. f. Kryst., XXVI, pp. 156–177, 1896.

[4] Annals N. Y. Acad. Sci., IX, pp. 124–178, June, 1896.

**On the Zonal Structure of Crystals.**—Pelikan[5] discusses the peculiarities of augite, barite, cassiterite, calcite, tourmaline and fluorite as regards their growth in zones. Of these, the first two are especially interesting. The literature on the hour-glass and zonal structure of augite is reviewed, after which are given the results of work on the well-known "hourglass" augites of Nordmark. This structure has been shown to be due to the varying conditions of deposition on the various faces of a growing crystal. That portion of the augite substance which was deposited on the orthopinacoid is found to be darker in color and to have a larger angle between $\dot{c}$ and c than the material which grew on the base or orthodome. In the darker portions this angle is greater for violet than for red rays, while in the lighter parts the reverse is true. Etched figures show a hemihedral symmetry for some pyroxenes, thus confirming observations that have been made, in rare cases, on the crystal form. In barite the crystal faces show a selective force, so that hematite and cinnabar, for instance, are found chiefly on the macrodome (101). So far as known, there are always other than isomorphous molecules present in those cases where different substances are deposited on different face.

After classifying the various causes of zonal distribution of color in crystals, the conclusion is drawn that hourglass structure is never caused by an intermixture of isomorphous substance, but by the presence of some differently crystallizing coloring matter, or by a "dilute color."

**Miscellaneous Notes.**—With the close of the year 1896, came the last brochures of the second volume of Hinze's *Handbuch der Mineralogie*, already referred to in the NATURALIST, Vol. XXV, 1891, p. 577. This second volume (the first has not yet been published) treats only the silicates, devoting more than 1800 pages to the discussion of these minerals alone. It is by far the most complete, as well as the most recent, work of its kind. The appearance of the first volume will be looked for with much anticipation by mineralogists. It is published by Veit & Co., Leipzig.

A. P. Brown[6] finds, on some unprecedentedly fine molybdenite crystals from Frankford, Pa., the axial ratio $a:c=1:1.908$. The faces observed are: c $(0001, {}^{\circ}P)$, o $(10\bar{1}1, P)$, p $(20\bar{2}1, 2P)$, q $(30\bar{3}1, 3P)$, and m $(10\bar{1}0, \infty P)$. The angle $c:p=77^{\circ}\ 13'$. The pyramid p $(20\bar{2}1)$

[5] Tschermak's Min. Pet. Mitth., XVI, pp. 1–64, 1896.
[6] Proc. Acad. Nat. Sci. Philadelphia, 1896, pp. 210–211.

is more common than the unit pyramid. The etched figures on the base indicate hexagonal, or possibly rhombohedral symmetry.

In agreement with the observations of de Bournon, Bauer and others, Judd[7] considers the structural planes of corundum to be not true cleavages, but simply planes of parting. Those parallel to 0R (0001) and $\infty P2$ $(11\bar{2}0)$ are thought to be normal solution planes, while the set parallel to R $(10\bar{1}1)$ are explained as gliding planes which, after the gliding under pressure, have become secondary solution planes. Observations on the shape and crystallographic position of the solution cavities are recorded. These are either empty or filled with the products of alteration.

Spencer[8] gives a full list of the literature of enargite, as well as of its places of occurrence. He cites for the first time the ten new planes, (610), (520), (540), (230), (108), (207), (709), (301), (601) and (054). Of these (610) and (601) are noted as doubtful. The mineral clarite (Sandberger, N. J. B., 1874, p. 960 and 1875, p. 382) is considered to be identical with enargite.

The relationships of the members of the humite series are reviewed by Lewis,[9] who brings the orthorhombic pyroxenes, as well as olivine, into the discussion. Besides the well-known progression in the axial ratios, the remarkable fact is noted that the twin face in all these minerals is parallel to the b axis, and in all except clinohumite it makes an angle of about 30° with the base (001). In clinohumite it has a position about at right angles to that in the other minerals. Another common feature is the great predominance of forms lying in the zones 010, $1\bar{1}0$ and $2\bar{1}0$. The minerals are similar in density, hardness and fusibility. The moleculare volumes are:—

| | | |
|---|---|---|
| Enstatite, | 32.8 | $= \frac{3}{2} \times 21.9$ |
| Olivine, | 44 | $= 2 \times 22$ |
| Chondrodite, | 105.6 | $= 5 \times 21.1$ |
| Humite, | 150 | $= 7 \times 21.4$ |
| Clinohumite, | 182.1 | $= 9 \times 20.2$ |

(*Note.*—The molecular volume of clinohumite is probably too low, as given here. From the first three minerals one might compute the volumes of MgO (11.2), $SiO_2$ (21.6), and $Mg_2O\ (OH, F)_2$ (28.8). This would give for humite the molecular volume 149.6, and for clinohumite, 193.6.)

[7] Min. Mag., Vol. XI, Sept., 1895, pp. 49–55.
[8] Min. Mag., Vol. XI, Sept., 1895, pp. 69–79.
[9] Min. Mag., XI, Oct., 1896, pp. 137–140.

## PETROGRAPHY.[1]

**Ancient Volcanic Rocks in Pennsylvania.**—Reference has already[2] been made in these notes to the discovery of ancient acid and basic volcanic lavas and tuffs at South Mountain, Pa. Miss Bascom[3] has recently given an exhaustive account of all the types of these rocks, which account is beautifully illustrated by reproductions of microphotographs and of colored drawings, and by a large scale geological map. The volcanic lavas are partly devitrified rhyolites and partly altered basalts. A brief notice of the former was given several years ago.[4] The present report adds much of detailed information concerning them to that already imparted, but nothing of general interest. These lavas are pre-Cambrian, and are probably older than the basic rocks with which they are associated in the Monterey district. The basic lavas were originally diabases, augite-porphyrites and melaphyres. They have suffered extreme alteration in consequence of weathering and also as a result of squeezing. Nearly all the rocks are schistose, the most highly schistose ones being now practically slates.

**Rocks Associated with the Magnetites near Port Henry, N. Y.**—The rocks associated with the non-titaniferous magnetites at Mineville and near Port Henry, N. Y., are described by Kemp[5] as gneisses and gabbro. Four varieties of the gneiss are distinguished, of which three are acid and one basic. One of the acid gneisses consists of quartz and plagioclase exclusively. Another is composed of these minerals and a large proportion of micro-perthite, and the third of brown hornblende, green augite and rarely hypesthene, in addition to the feldspars and quartz. The basic gneiss is a schistose gabbro. It grades into the massive gabbro. In some phases hornblende and much garnet are present. All the gneisses, as well as the gabbro, are thought to be igneous in origin and to be pre-Cambrian in age. The ore deposits are on the contact of the acid and the basic rocks. While their method of origin is not certainly known, it is believed by the author that the ores may be contact products resulting from the action of the intrusive gabbro upon the gneisses intruded by it.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] American Naturalist, 1894, pp. 515, 517 and 949.

[3] Bull. U. S. Geol. Survey, No. 136, Washington, 1896.

[4] American Naturalist, p. 515.

[5] Trans. Amer. Inst. Min. Eng., 1897.

**The Basalts of Klöch in Steiermark.**—The main portions of the Klöch Mountain mass are basalts and their tuffs. Sigmund[6] describes these and the other rocks in their vicinity as nepheline basanites, palagonite tuffs, nephelinites and nepheline basalts.

All the augites in the basanites have the "hourglass form," and all the feldspars are bytomites. The augites are also zonal with a colorless nucleus and a violet-gray peripheral portion. The extinction of the nucleus is higher than that of the surrounding portion, and the extinction in the pyramidal zone of growth (Anwachs-Kegel) greater than that in the prismatic zone. The nephelinite of the Hochstraden contains two augites. The larger consists of colorless nuclei and greenish-yellow peripheral zones, while the smaller ones are composed entirely of the greenish-yellow material. Hauyn is an essential component of the groundmass. In some specimens it occurs in as large quantity as the nepheline. An analysis of this rock gave:

| $SiO_2$ | $Tio_2$ | $Al_2O_3$ | $Fe_2O_3$ | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $SO_3$ | Cl. | Loss | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.99 | 2.41 | 16.50 | 10.62 | .35 | 3.29 | 12.63 | 5.95 | 2.36 | .89 | .64 | .36 | 2.63 = | 99.62 |

The basalt of Klöch and the nephelinite of the Hochstraden are thought to have been produced by the differentiation of one magma.

**The Volcanic Rocks near Bensen, Bohemia.**—Hibsch,[7] in his description of the Bensen sheet of the Bohemian Mittelgebirge, gives brief accounts of the basalts, augitites, tephrites, basanites, phonolites and trachytes occurring as lavas and tuffs, and of the camptonitic, trachyte-andesitic and tinguaitic dykes so common in the district. The basalts, which are the oldest lavas, form stocks, sheets and dykes; the tephrites, which are the next older, occur in sheets and as tuffs, and the phonolites and trachytes as bosses. The tinguaite dykes are connected with the phonolitic intrusion at Mühlörzen, but the others are more closely connected with the volcanic center at Rongstock. All the eruptives are Tertiary or younger. The most interesting of these rocks is in the trachyte-andesite dyke. The author describes it under the name of gauteite, and regards it as the complementary form to the monchiquites. It is a rock of a light color and trachytic habit. In composition it differs from bostonite-porphyry in the possession of phenocrysts of plagioclase. It consists of large porphyritic crystals of hornblende, augite, plagioclase and occasionally biotite in a groundmass composed of the same dark minerals, sanidine and andesine, cemented by glass. An analysis yielded:

[6] Min. u. Petrog. Mittheilungen, XV, p. 361 and XVI, p. 337.

[7] Ib., B., XVII, p. 1.

| $Si_2O$ | $Ti_2O$ | $P_2O_5$ | $Al_2O_3$ | $Fe_2O_3$ | Feo | CaO | MgO | $K_2O$ | $Na_2O$ | $H_2O$ | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54.15 | tr. | .41 | 18.25 | 3.62 | 2.09 | 4.89 | 2.56 | 6.56 | 4.43 | 3.69 | = 100.65 | Density = 2.632 |

The basalts include feldspathic, nephelinic and magma basalts, analysis of the first two of which are here given:

| $SiO_2$ | $TiO_2$ | $P_2O_5$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | CaO | MgO | $K_2O$ | $Na_2O$ | $H_2O$ | $CO_2$ | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42.75 | 2.13 | tr. | 17.24 | 8.10 | 5.88 | 11.14 | 6.17 | 2 48 | 4.21 | 1.06 | | = 101.16 |
| 39.33 | 1.01 | .93 | 15.26 | 6.36 | 5.99 | 14.52 | 9.78 | 1.53 | 3.47 | 2.54 | 0.12 | = 100.84 |

The tephrites are phonolitic and basaltic hauyne-tephrites, sodalite-tephrites, nepheline-tephrites and leucite-tephrites. The phonolite contains great quantities of anorthoclase in large crystals. Some phases of the rock are noticeable for their phenocrysts of sodalite and others for their phenocrysts of nepheline. The other rocks possess no special features.

**The Law Governing the Production of Zonal Crystals.**—The law governing the occurrence of zonally developed crystals is as follows, according to Becke[8]: In the zonally developed isomorphous mixed crystals of igneous rocks the more difficultly fusible components constitute the nuclei, and the more easily fusible ones the peripheral zones of the crystals.

**Petrographical Notes.**—Diller[9] has discovered a boulder of hornblende-basalt in Kosk Creek at the great bend of Pitt River in Shasta Co., Cal. It is interesting not so much because of its features, but because of the rarity of the type in the district. An analysis yielded:

| $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | CaO | MgO | $K_2O$ | $Na_2O$ | $H_2O$ | $P_2O_5$ | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44.77 | .53 | 17.82 | 5.05 | 6.95 | tr. | 10.36 | 8.22 | .92 | 2.13 | 2.64 | .72 | = 100.11 |

The Seychelles Islands in the Indian Ocean are described by Bauer[10] as being composed principally of hornblende, granite and of syenite cut by dykes and covered in places by sheets of granite-porphyry, felsite-porphyry, syenite-porphyry, hornblende-vogesite, diorite, quartz-diorite, diabase, melaphyre and dolerite. The sedimentary rocks on the island are in very small quantity. They consist mainly of andalusite-hornfels and other contact rocks.

[8] Min. u. Petrog. Mitth., Vol. XVII, 1897, p. 97.
[9] Amer. Geologist, Vol. XIX, 1897, p. 253.
[10] Sitzb. Ges. z Beförd gesammnt. Naturw. zu Marburg, Feb., 1897.

## GEOLOGY AND PALEONTOLOGY.

**Geology of Alaska.**—In a report on the Coal and Lignite of Alaska Dr. Dall publishes some general notes on the Cenozoic geology of the Territory. In general, the sequence of rocks along the southeastern coast where undisturbed is about as follows, in descending order:

"1. Soil and Pleistocene beds."

"2. Brown Miocene sandstones, with marine shells, cetacean bones, and water-worn, teredo-bored fossil wood (Astoria group, Nulato sandstones, Crepidula bed)."

"3. Beds of conglomerate, brown and iron-stained, alternating with gravelly and sandy layers, the finer beds containing fossil leaves of Sequoia and other vegetable remains. (Kenai group, Nuga beds)."

"4. Bluish sandy slates and shales, with rich plant flora, interstratified with beds of indurated gravel, fossil wood, and lignitic coal (Kenai group)."

"5. Metamorphic quartzites and slaty rocks, with perhaps part of the lower Eocene (Tejon)."

"6. Granite and syenite in massive beds, usually without mica and apparently in most instances forming the "back bone" of the mountain ridges or islands, but occasionally occurring as instrusive masses, which have thrust up the metamorphic rocks above them into arches, cracking them, and filling the fissures with the syenitic material. ("Sumagin granite)."

The author correlates the Kenai group with the Oligocene of European geologists. The beds overlying the Kenai conglomerates and leaf beds are undoubtedly Miocene. Mr. Dall concludes from a comparison of their fauna with modern forms that in Miocene times the waters of this region were warmer than at present.

The Pleistocene epoch is marked in Alaska, as in California, by great changes of level, and by volcanic activity. To this period is assigned the ground ice formation which has been recognized in many places in the northern part of Alaska. This consists of solid beds of ice of considerable thickness, functioning as rock strata, which are covered by beds of blue clay containing remains of Pleistocene mammals, or by beds of alluvium which sustain a layer of turf, with ordinary profuse herbage of the region, or even small thickets of birch, alder, and other small Arctic trees.

The paleontology of the Territory is made the subject of special papers by Knowlton, Schuchert, and Hyatt which appear as appendices to Dr. Dall's report. The fossil flora embraces 115 forms, the most of which appear to be of Eocene or Oliogocene age. Mr. Knowlton concludes from a comparison of the Alaskan fossil flora with that of Greenland Spitzbergen and the island of Sakhalin that they are all so closely related that they probably grew under similar conditions and were synchronously deposited.

Faunal collections from Alaska are meager. As yet a few forms only, representing Silurian, Devonian, Carboniferous and Mesozoic beds, are known. According to Hyatt, the existence of the Cretaceous has not yet been demonstrated in Alaska, unless the Ancellæ described by Eichwald are Cretacic species. (Seventeenth Ann. Rept. U. S. Geol. Survey Pt. I, Washington, 1896.)

**Phylogeny of Dæmonelix.**—The strange fossil, popularly known as Devil's Corkscrew, has been of interest since its first discovery in 1891. During a recent expedition to the Loup Fork Tertiary Mr. E. H. Barbour made a study of these fossils *in situ* where a succession of them were exposed in a canyon. In passing from the lower beds to the higher forms varying from simplicity and uniformity to those of ever-increasing diversity and complexity are found, the climax being reached in the topmost beds. The simplest form of the Dæmonelix series is a hollow tubule or fiber, and the author's belief is that it is according to the arrangement or aggregation of these fibers that the multifarious forms result.

The second form, for lack of a better name, is termed "Dæmonelix Cakes." They are commonly circular in form, 5 to 10 centimeters across, and form ½ to 2 centimeters thick. They lie in horizontal planes through a vertical range of some six to eight meters. Overlying these were "balls," very similar to the preceding forms, but smaller in circumference and of greater complexity structurally.

The third form resembles cigars or fingers. In outward appearance they have acquired a pronounced vertical habit and a noticeable tendency to a spiral form. They are about the size of an ordinary cane. These are succeeded by an irregular spiral form, found through a vertical range of six to eight meters in the middle beds. This form, as well as the preceding, ends in blunt rounded terminations sealed or capped with fibers, leaving neither exit or entrance for supposed occupants of so-called burrows. Lastly we have the "Dæmonelix regular." A sheer wall exposes to view a section 40 to 45 meters from

bottom to top, with innumerable twisters at every level. Those at the bottom are constructed upon smaller and more uniform lines and stand in bold contrast to the large and diversified forms at the top.

Microscopic sections from all the five forms to the number of 120 demonstrate the fact that there is an apparent similarity of tissue in all and that it is cellular, but not vascular. Mr. Barbour's conclusions relate only to the first three forms and the surface structure of the great cork screws. The central spiral tube is under consideration. He suggests that it may represent the root of some higher plant about which the original Dæmonelix fibers grew. (Bull. Geol. Soc. Amer., Vol. 8, 1897.)

**The Nature, Structure and Phylogeny of Dæmonelix.**[1]—Prof. Barbour brings forth in this, his latest paper on the peculiar fossil popularly known in the region where it is found as the "Devil's corkscrew," additional evidence to support his already well supported conclusion that the fossil is that of an aquatic plant. The figures that he gives of sections showing plant parenchymatous cells in cross and in longitudinal section are much superior to any that he has previously published. The evidence that they form, together with the evidence of slides sent the writer, is conclusive. The fossil was a plant and is not the mould of the roots of some plant.

But in this and in a preceding paper[2] Prof. Barbour goes further than previously and cautiously claims to be able to make out the phylogeny of the fossil. At the bottom of the beds in which Dæmonelix occurs there are to be found irregular filamentous remains; above these, cake-like masses; above these, large irregular root-like forms that gradually metamorphose into regular screw-like forms. All present the same parenchymatous cellular structure when viewed in carefully made sections beneath the microscope. The author's idea is a bright, and it may be added, a daring one—daring in view of the tremendous change that is claimed to have taken place within the brief interval of geological time represented by the 250 to 300 feet of sediment forming the fossil bed. According to ideas more or less generally accepted, if the writer mistakes not, the waters of the great pliocene lake in which these fossils flourished are supposed to have been comparatively heavily laden with sediment, and as the structure of the beds shows, that it

[1] E. H. Barbour, Bul. Geol. Soc. Amer., VIII, 305–14. Reprint from the author.

[2] History of the Discovery and Report of Progress in the study of Dæmonelix. University Studies, Lincoln, Nebraska, Jan., 1887., II, 81–125.

was deposited rapidly. The change from the filamentous fossils to the well formed Dæmonelix is as great, or greater perhaps, than the difference between a simple infusorian and a sponge, or as that between a simple Spirogyra and a Fucus. No where in the animal kingdom and nowhere else in the vegetable kingdom is there to be found paleontological evidence of so rapid a change.

Yet it must be admitted that, although the rapid change required weighs heavily against Barbour's suggestion, it does not form a conclusive argument. Both animals and plants are known to yield readily to surrounding physical conditions, and great and anomalous changes are known to occur at a single leap as it were in many of the cases that fall under what we commonly call monstrosities. Granting that the change indicated by the series that the author thinks he has demonstrated is a possible one, there remains the greater and more important task of showing the existence at the time that these fossils plants were growing of causes adequate to produce it. This done the author's hypothesis will be practically unassailable.

In as much as the plants were aquatic one would not, judging from the analogy of aquatic organisms in other instances, expect so rapid a change as in the case of land plants. Climatic conditions could doubtless have had but little influence. One is, therefore, left to inquire what changes may have occurred in the character and the quantity of the salts that the water of the lake held in solution, or of the sediment that it carried. As the writer remembers the fossil beds in question there is no very apparent evidence of a change in the character of the sediment. The beds are not laminated. The structure from bottom to top is throughout remarkably and uniformly of the same peculiar mixture of fine, indurated, calcareous sand. And it seems, therefore, that, if any cause is to be found, it must be looked for in the character or amount of the salts that were poured into and remained in the lake. As yet no one has shown that the silicious material of which the fossils are composed is more abundant at one level in the beds than at another, and the same may be said of the magnesium, potassium and other salts.

Evidently there is much work yet to be done in solving this Dæmonelix riddle notwithstanding the great amount of labor that Prof. Barbour has already expended upon it, and it is to be hoped that he will find the necessary time and encouragement for continuing his work both in the field and in the laboratory. Besides an answer to the questions implied in the foregoing remarks there are needed answers to other questions regarding the structure of the fossil.—F. C. KENYON.

**Origin of the Edentates.**—Dr. Wortman has come into possession of material which, in his judgment demonstrates the genetic relationship of the Ganodonta to the later appearing American Edentata. In considering the Ganodonta the author points out the features which characterize the genera composing the family and which become more and more marked as the respective phyla advance into later time. These features relate to the loss of the incisors, the weak development and loss of the enamel, and the development of hypsodonty with its dependent modification growth from a persistent pulp. Of one phylum, viz. the Stylinodontidæ, Dr. Wortman has remarkably complete record, beginning in the generalized type Hemiganus of Lower Puerco, and continued into the Bridger, terminating in Stylinodon. In a comparison of this group with the Ground Sloths (Gravigrada) the author enumerates 17 points of resemblance which he considers sufficient evidence to demonstrate that the one has descended from the other. The next inference then is that all the South American Edentates must have been derived from the North American Ganodonta, since their earliest appearance in South America does not antedate the Santa Cruz epoch. But this necessitates a land bridge between North and South America during Eocene times, which is contrary to the accepted belief among geologists. In closing Mr. Wortman defines the order Edentata and its three suborders, Ganodonta, Xenarthra and Nomarthra with their families, and distinguishes the genera of the Ganodonta. (Bull. Amer. Mus. Nat. Hist., Vol. IX, 1897.)

**Gypsum Deposits of Kansas.**—The following information concerning the gypsum beds of Kansas was obtained by Mr. G. P. Grimsley during a field investigation of the region in which they occur:

"The gypsum beds of economic importance in Kansas are all Permian in age, ranging from middle Permian or Neosho to the close. They cover a belt approximately 200 miles long, 10 miles in width at the north, 20 miles in central Kansas, and 60 miles in the southern part of the state. The deposit is 8 feet thick in northern Kansas, 14 feet in the central area, 25 feet in the southern area, and even thicker further south. The northern and central rock gypsum was deposited in the same gulf cut off from the western Permian sea, while the gypseous dirt deposits are secondary and of recent age. The southern deposit was formed in a shallow bay cut off from the Permian sea, not far from the close of Permian time. Salt appears to have been deposited in these bays, but now it is only found farther out in the old gulf." (Bull. Geol. Soc. Amer., Vol. 8, 1897.)

**Geology of the Funafuti Coral Reef.**—The following summary is given by Mr. Hedley of the geological results of his observations while attached to the Funafuti Coral Reef Boring Expedition:

"(a) An elevation of Funafuti by at least 4 feet is proved by dead sub-fossil reef-corals in the position of life near high water-mark. (b) Darwin's theory of coral reefs, as opposed to Murray's, is favored by these facts: (1) Soundings show the atoll to be planted, not on a bank, but on a cone; (2) they also show it girdled by a precipitous submarine cliff, explicable only on the subsidence theory; (3) our observations and the experience of residents agree that the lagoon is filling up, whereas Murray demands its excavation, (c) A peripheral growth at present level is indicated on both sides of the islets." (Mem. III, 1897, Australian Museum.)

**Geological News.**—General.—Two kinds of mountain ranges are recognized by Dr. LeConte, classified by their generating forces. The one is anteclinal, the other monoclinal. As to cause the one is formed by lateral squeezing and strata-folding, the other by lateral stretching, fracturing, block-tilting, and unequal settling. As to place of birth, the one is born of marginal sea bottoms, the other is formed in the land crust. (Bull. Geol. Soc. Amer., Vol. 8, 1897.)

The fossil phyllopod genera, Dipeltis and Protocaris, according to Schuchert, are representatives of the Apodidæ family. The history of this family, therefore extends throughout the time of the entire known fossil-bearing rocks, as Protocaris occurs at the base of the Lower Cambrian. The fossil forms are generally marine, while all the recent species are denizens of fresh water ponds and pools. (Proceeds. U. S. Natl. Mus., Vol. XIX, 1897.)

Paleozoic.—In a revision of the fossil sponges found in the Quebec Group at Little Metis on the St. Lawrence River, Sir Wm. Dawson describes 14 species all belonging to the order Silicea. Of these, one, *Lasiothrix flabellata,* is new. Other animal remains from the same deposit are a small brachiopod, *Obolella pretiosa,* trails and castings of worms, and fragments of triobites, cystideans and Graptolites. (Trans. Roy. Soc. Canada, 1896–97.)

Some interesting vertebrate remains from the Kansas Permian are recorded by Williston, representing the genera Cricotus and Clepsydrops Cope. The characters do not warrant specific distinction from forms described by Cope from Danville, Illinois. The author calls attention to the close resemblance of the two series of forms and considers it a demonstration of the contemporaneity of the Illinois and

Kansas beds, as well as those of the Texas Permian, whence species of these genera have been described by Cope. (Kan. Univ. Quart., Vol. VI, 1897.)

MESOZOIC.—For the full classification of the Cycadaceæ Dr. Lester Ward proposes to use that term to represent the entire family, both living and fossil, and to subdivide it into the two subfamilies, the Cycadeæ for the living forms and the Cycadeoideæ for the fossil forms. Dr. Ward adopts this form of classification in his descriptions of species of fossil Cycads from the iron ore belt, Potomac formation of Maryland. In this collection seven species are recognized, of which six are new. (Proceeds. Biol. Soc., Washington, Vol. XI, 1897.)

The Museum at Caen, France is in possession of four reptiles from the Jurassic deposits of Normandy. These are identified by M. Bigot as *Steneosaurus roissyi* E. Desl., *S. intermedius* (n. sp.), *S. hebertii* Morel de Glasville and *Suchodus durobrivensis* Lydekker. All the specimens are fully described, and the new species figured. (Bull. Soc. Geol. de Normandie, t. XVII, 1896.)

The University of Denver has come into possession of a fossil Mosasaurid found near Flagler, Colo. It is interesting from the fact that there has been but one other Mosasaurid found in Colorado and also from the fact that it seems to be a new species.

It was thought, until within a year, that the Mosasaurids did not inhabit the ancient seas of Colorado, but existed only further toward the east. A few months ago, some bones which were probably from a Mosasaurid were found near Canyon city. These and the bones which I have, prove that the reptiles lived in the seas of Colorado.

From all I am able to learn of the reptile, I must conclude that it is a new species. It is possibly of the genus Clidastes. The description of this genus corresponds fairly well, though there seems room for doubt. The absence of characteristic parts makes the identification uncertain.

The vertebral column is about five meters in length and is composed of ninety vertebræ. Some parts of the jaw and limbs are also preserved. The authorities at the National Museum, Washington, to whom I sent some of the bones, write that I "probably have one of the most complete vertebral columns of this group of marine reptiles (Clidastes) in existence. The tail is particularly fine and gives me a much better impression of the depth and compression of this part of the body."—W. T. LEE.

CENOZOIC.—The following is the history of Crater Lake, Oregon, as worked out by Mr. J. S. Diller.

During the early glacial period Crater Lake did not exist, its site being occupied by an active volcano, Mt. Mazama. During the final great eruption of this volcano its summit caved in giving rise to a caldera nearly six miles in diameter and four thousand feet deep. Upon the bottom of the caldera volcanic activity continued. There were new eruptions forming cinder cones and lava fields partially refilling the great pit. Volcanic activity ceasing, the conditions were favorable for water accumulation and Crater Lake was formed in the pit. (Amer. Journ. Sci., Vol. II, 1897.)

From a study of parts of Labrador and Baffin Land Mr. R. S. Tarr concludes that all of that region, except possibly, the highest parts, has been buried beneath an ice sheet and there is evidence that the ice has withdrawn from these regions in very recent times. Down cutting of the surface by glacial action is more marked in Labrador than in Baffin Land. Post-glacial weathering is very pronounced in both regions. (Amer. Geol., Vol, XIX, 1897.)

## BOTANY.[1]

**Botanical Society of America.**—The Third Annual Meeting of the Society will be held in Toronto on Tuesday and Wednesday, August 17th and 18th, 1897, under the presidency of Dr. John M. Coulter. The Council will meet at 1 P. M. on Tuesday, and the first session of the Society will begin at 3 P. M. The address of the retiring President, Dr. Charles E. Bessey, will be given on Tuesday evening at 8 o'clock.

The British Association for the Advancement of Science will meet in Toronto, August 18th to 25th. The opening address is to be given on Wednesday evening, August 18th. Professor A. B. Macallum, President of the Local Executive Committee, writes:

"A great many of the members of the Botanical Section of the B. A. A. S. are booked to leave Liverpool August 5th. They will arrive in Quebec and Montreal, if they make the usual time, by the 14th and 15th respectively, and will be in Toronto on Tuesday evening (17th) at latest. Some may stay over at Montreal and Ottawa and possibly

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

Kingston, arranging to arrive in Toronto Wednesday morning. The latter date will find nearly all of them here. Those who do not come via Quebec will turn up in Toronto at an earlier date probably. We expect a fairly large contingent, including some continental botanists of note."

It is expected, therefore, that this meeting will give unusual opportunities for renewing or forming acquaintances among British and continental botanists. By authority of the Council all foreign botanists present will be invited to sit as associate members of the Society and to read papers. This invitation will be addressed personally to all whose intention to come Toronto is known, and will also be published in *Nature* and the *Journal of Botany.*

A later announcement will contain information regarding R. R. rates, hotels, rooms for meeting, and other business to be submitted to the Society.—C. R. BARNES, *Secretary.*

**Botany in the National Educational Association.**—It is encouraging to notice that in the great gatherings of teachers modern methods in science teaching are receiving attention. Last year in the Buffalo meeting of the National Educational Association, Professor Atkinson, of Cornell University, and Professor Spalding, of the University of Michigan, discussed the educational value of botany. This year in the Milwaukee meeting Professor Barnes, of the University of Wisconsin, is to read a paper on "What can the High School do with Botany?" It is to be hoped that the masters in botany will continue to take part in these discussions. The teachers in the secondary schools are quite generally ready to receive suggestions as to better methods when given by those who are entitled to speak with authority.

CHARLES E. BESSEY.

**The Marine Biological Laboratory at Wood's Holl, Mass.**—The tenth season of this useful laboratory is announced. The botanical instruction will cover a period of six weeks from July 6th, and will be conducted by Dr. Bradley M. Davis, of the University of Chicago. Two courses will be offered, viz., (1) on Elementary Botany, and (2) on the Morphology of the Algæ. In the first one week each will be given to Algæ, Fungi, Bryophytes and Pteridophytes, and two weeks to the Spermatophytes. There should be many students in attendance. The botanical advantages of Wood's Holl should attract many of the teachers in the High Schools and smaller colleges.

CHARLES E. BESSEY.

**A New Beginner's Botany.**—In a neat little volume published by The Macmillan Company, Professor Setchell has given us his ideas of laboratory practice for beginners in botany. These successive volumes from the professors of Botany in the universities are interesting, since they show us what their authors think can be done in the secondary schools under present conditions. They are thus contributions to the science of education, and ought to be judged accordingly.

In this book Professor Setchell puts before us his plan of presenting elementary botany to beginners, resting it upon two general conclusions reached after experience "with a number of classes of beginners both in the preparatory schools and the university" as follows:

"Botany in the preparatory schools should be taught—

"1. As a science, to cultivate careful and accurate observation, together with the faculty of making from observations the proper inferences; and

"2. As a means of leading the mind of the student to interest itself in the phenomena of nature for its own further development and profit."

These are certainly sound principles, and we may welcome the book as the author's exposition of them. Upon opening it at page 1, we find that the pupil is directed to "take a ripened pod of a Bean Plant, and splitting it open, notice:

"1. That the seeds (Beans) are attached along one edge of each valve (or half) of the pod.

"2. That each bean is attached to the pod by a short stalk, the *funiculus.*

"3. Make a sketch of a valve of the bean pod with its enclosed beans, representing and labelling the parts."

In this way the separate beans are taken up and their details worked out until the pupil has a knowledge of the pod, valves seeds, funiculus, hilum, strophiole, seed-coats, raphe, micropyle, chalaza, embryo, cotyledons, caulicle, plumule, etc. Peas, Castor-beans, Morning-glory seeds, Indian Corn, Onion seeds, and seeds of Piñon Pine are to be taken in succession and studied in like manner. Then seedlings are studied, followed by roots, stems, leaves, (including phyllotaxy) and buds. Next follow chapters on protection (thorns, spines, hairs, bitter or acid juice), storage (in roots, bulbs, leaves, etc.), climbing plants, epiphytes, parasites, saprophytes and insectivorous plants, in which the pupil is made acquainted with these various subjects by a laboratory study of fresh examples. Thus the author leads the pupil on through the structure of flowering plants, always by means of actual examples.

The book thus emphasizes the principle that botany is the study of *plants*, not the study of *books*. Books, however, are not to be ignored or neglected, and short lists of desirable reference books are given. It is significant of the spirit of the book that it is only " when the student shall have finished a careful study of the morphology of the more conspicuous plants, and has seen some of the more important modifications of the different organs, to perform different services to the plant," that the author suggests the use of " a suitable manual of the botany of the region, from which the name and relationships of the species may be obtained." But even after this cautious suggestion of the use of a manual, the author is constrained to say that " the name should not be the end for which the work is done," and " the teacher should prevent this searching out of the name and the practice in the use of the analytical key from absorbing the principal portion of the attention." Thus, although the book is distinctly " phanerogamous," it is as emphatically a laboratory manual, as any of the text-books devoted to the minute anatomy of plants.

The last stronghold of the old time text-book botanists is thus assaulted from an unexpected quarter. Hitherto they have been able to defend themselves with more or less success by crying out against early study by the pupil of small and little known things, as cells, nuclei, green slimes, pond scums, etc. (characterized by one educator as " recondite "), and making a great ado over the difficulty (sometimes asserted to be an impossibility) of supplying the secondary schools with compound microscopes. Professor Setchell has turned flowering plant botany into a laboratory study, and has done so without bringing in anything more recondite than seeds and embryos, or more difficult of purchase than pocket lenses and dissecting needles.

It would be easy to find faults in this book (what book on botany is free from them ?) but we feel that it is likely to do so much good in certain quarters that we will say no more than that in our opinion elementary botany should include a good deal about the simpler forms of plants, so that the pupil may obtain some idea of types. It is as good a principle in botany as in mathematics, that we must begin with simple things and proceed to the complex, in order to understand the latter. Then again we know from many years of personal experience, and this not in an old and wealthy community, that the purchase of good compound microscopes (duty free), and the installation of small but efficient laboratories in secondary schools, is as easily accomplished for botany as is the purchase of necessary apparatus and the fitting up of proper laboratories for chemistry. In the new state of Nebraska

nearly every accredited high school is now using the compound microscope in the study of plants selected as types of all the greater groups of the vegetable kingdom. We may be permitted to remark, also, that in practice it will be found impossible to secure in nine-tenths of the secondary schools, much of the material suggested by the author for study. In many chapters the teacher may readily make substitutions, but in those relating to epiphytes, parasites, saprophytes and insectivorous plants, this difficulty will prove quite embarrassing.

—CHARLES E. BESSEY.

## ZOOLOGY.

**The orientation of organisms by light.**[1]—The problem that the author undertakes to solve is whether the migration of organisms towards or from a source of light is due to differences in intensity or to the direction of the rays. According to Strasburger, whose views have been more or less generally accepted, the determinant factor is the direction of the rays. His conclusions drawn from experiments with swarm spores of Botrydium and Bayopsis (78) were later (90) confirmed by Loeb in experiments with the larvæ of *Porthesia chrysorrhœa.* But this view of the subject has been opposed by Oltmann (92) as the result of certain experiments performed with *Volvox minor* and *globator;* and Oltman has been supported by Verworn (94).

Davenport and Cannon criticise Oltman's management of his apparatus and themselves attack the problem with what is essentially the method of Strasburger, but use Daphnia instead of plants. A small glass trough was painted dead black inside and out and placed on a table at a distance, at its nearest end, of 51 cm. and of 66.5 cm. at its further end, from the light of a gas lamp having a Welsbach burner which was raised 31 cm. above the table. A wedge shaped box with glass bottom and filled with India ink solution served, when needed, as a screen, the thicker portion of the wedge being placed nearest the source of the rays.

Experiments without the screen showed that the Daphniæ when introduced at the end of the trough farthest from the source of light

[1] C. B. Davenport and W. B. Cannon. On the Determination of the Direction and Rate of movement of organisms by Light. Reprint from Journ. Phys. XXI, 22-32. From Dr. C. B. Davenport.

invariably moved towards the light. When the screen was interposed and all other light than that from the lamp excluded the same result was obtained. They were introduced into the trough at its middle point, still the result was the same. Of 39 individuals introduced at the end of the trough most distant from the light 54 per cent. passed the middle line towards the light, 43 per cent made the entire trip of the length of the trough. Only one of the 39 remained at the starting point.

When introduced at the middle of the trough 57 per cent. of 58 Daphniæ made the entire trip in two minutes. In all 67 per cent. moved towards the light, 12 remained at the starting point and three of these were caught in floating bubbles, 6 individuals, or the remainder, moved away from the light. But these scarcely affect the general result.

From the difference in the distances of the two ends of the trough from the source of the light the authors calculate that the difference in the intensity of the light at the two ends of a Daphnia .1 mm. long exposed to the unobstructed rays is somewhere between .0027 and .0031 of the intensity of the light at one end of its body. But when the screen is used the difference at the thicker end of the wedge will be as great as .0034 of the intensity at one end of the Daphnia and will increase to about 17 per cent. at the edge of the wedge. Consequently, in as much as the decrease in intensity an account of the increasing thickness of the screen is greater than the increase due to greater proximity of the light the authors conclude that the effect of variations in the intensity of the light must be ruled out of court leaving as the only possible cause of the movements of the animals the direction of the light rays. The difference of opinion, it is pointed out, has been due to a failure to distinguish between phototaxis, or the response to the direction of rays, and photopathy, or the response to variations in intensity.

**The relation between intensity of light and rapidity of movement.**—In the same paper these authors just mentioned endeavor to answer the question, "Do positively phototactic organisms move more rapidly toward their optimum intensity of light than toward an intensity below the optimum?"

The method by which the authors attacked this problem was similar to the one just mentioned. The trough was similarly placed at a horizontal distance of 50 cm. from the burner. In order to guage the intensity of the light an index was attached to the gas cock so that one-fourth and full light could be obtained immediately without the use of

a photometer for each experiment. Diffuse light was cut off from the trough by placing this in a second trough with high walls.

The Daphinæ were introduced one at a time at the end of the trough most distant from the light and the time noted when they passed a point 2 cm. from the end of the trough, and again when they passed another point two centimeters distant from the other end. The difference then equalled the time of the trip.

Six series of experiments were performed which were divided into two groups. In the first group there was an alternation from full light to one-fourth light to full light again, and in the second group, from one-fourth to full to one-fourth light.

The distance travelled was 16 cm. The mean times in seconds found in the three series of the first group was 48 (full light), 57, (¼ light), and 31 (full light). In the second group it was 36 (¼ light), 28 (full light), and 30.5 (¼ light). The average time for the full light was 35.7 and for ¼ light 41.2, or expressed as a ratio of the former to the latter the time was 87 : 100.

Sixty trips made in the order of the averages just given in experiments with several individuals changed the ratio to 84 : 100.

The Diaphniæ acted differently when first put in the trough. In full light they started immediately, but in one-fourth light they evinced hesitating movements. This together with the absence of any close relation between the diminished intensity of light and the longer time required for migration in such light than in full light as shown in the averages obtained the authors conclude, and it seems justly, that the longer time required to migrate in the smaller amount of light is due not so much to the lower intensity as to diminished precision in orientation. And this leads to the further conclusion already reached in other experiments that light acts chiefly through the direction of its rays.

The authors' results bear out the conclusions of Nägeli (78) and of Strasburger, who says that the course of swarm spores is straightest in those areas that are brighest, as well as those of Loeb, who asserts that "the orientation of an animal in the direction of the rays is the more precise as the intensity increases."

The table of figures showing the time of the several trips brings out a further fact, namely, that the rate of movement increases with each succeeding trip made by the same animal. The succession averages for full light were 48, 31, and 28 seconds, and those for one-fourth light, 57, 36, and 30.5 seconds. The cause of this increase of speed the authors say they must leave undetermined, but it would seem from common experience that it may have been and probably was due to the animals'

experience with the circumstances in which it was placed.—F. C. Kenyon.

**A List of the Birds of the Vicinity of West Chester, Chester Co., Pennsylvania.**—The following list of birds is based upon the observations of a collecting period extending from 1885 to 1891, and again resumed in 1895. By far the greater part of my collecting has been limited to the country within a five miles' radius of the town of West Chester, that is, principally to the higher ground of the townships of West and East Goshen and West Whiteland to the north and east, and to the west and south the valley of the Brandywine Creek in East Bradford townships. All the species here annotated have been shot and identified by myself, with the exception of a few taken by collecting friends; but none are included in this list of which I have not seen specimens in the flesh. For a considerable number of the migratory species I have made notes on the time of their first occurrence in the spring, as well as of the time of arrival of the " bulk " of individuals for the given year, and for some species I have noted the time of arrival or departure in the fall. Many of these dates will be found to correspond very closely with those given by Witmer Stone in his " Birds of Eastern Pennsylvania and New Jersey," 1894. Further, I have endeavored to note the comparative abundance of the species as accurately as possible, and in this point my data would offer approximate correctness, since the area over which I have collected is comparatively limited in extent.

The rarest of the 145 species mentioned below are the following: *Aegialitis semipalmata* Bonap., *Ectopistes migratorius* (Linn.), *Zonotrichia leucophrys* (Forst.), *Lanius ludovicianus* Linn. and *Dendroica caerulea* (Wils.).

1. *Polilymbus podiceps* (Linn.), Pied-billed Grebe. A not infrequent migrant in the fall, along the Brandywine.

2. *Sterna* sp., Tern. I saw an individual of a small species of this genus (perhaps *S. hirundo* Linn.) shot on the Brandywine near Lenape, in the late summer of 1887. Owing to the rapid decomposition of the specimen, I was unable to identify the species.

3. *Anas discors* Linn., Blue-winged Teal. On Aug. 8, 1889, I shot an adult, and at the same time saw another individual, on the Brandywine near Lenape.

4. *Aix sponsa* (Linn.), Wood Duck. An infrequent summer resident on the Brandywine.

5. *Erismatura rubida* (Wils.), Ruddy Duck. I shot an adult female, March 15, 1890, in a marsh by the Brandywine at Lenape.

(In addition to the three species of duck here mentioned, I have seen two or three others, which I was unable to secure and identify.)

6. *Branta canadensis* (Linn.), Canada Goose. This species regularly migrates over our district in the spring, fall and winter.

7. *Botaurus lentiginosos* (Montag.), American Bittern. Rare; I have seen only two individuals, Aug. 3, 1887, and May, 1895, respectively. Both of these I saw very closely, so that there was no possibility of a confusion with the Night Heron.

8. *Ardea herodias* Linn., Great Blue Heron. An infrequent summer resident, becoming rarer each year. I noticed a pair during two summers in East Bradford, and have observed a few in the spring.

9. *A. virescens* Linn., Green Heron. Common summer resident.

(I have never found the Night Heron, *Nycticorax nycticoryx naevius* (Bodd.), in this neighborhood, though I have seen it frequently in adjoining parts of Delaware Co.).

10. *Porzana* sp., Rail. I picked up a badly decomposed specimen of this genus on a country road in late summer—*P. carolina* (Linn.)?

11. *Philohela minor* (Gmel.). American Woodcock. Infrequent migrant during the early spring and late fall.

12. *Gallinago delicata* (Ord.), Wilson's Snipe. A common migrant in the early spring (March 16 to April 25) and late fall, in the marshes along the Brandywine. It is to be found only occasionally in higher localities (West Goshen).

13. *Totanus solitarius* (Wils.), Solitary Sandpiper. This species is a regular migrant in the late spring, when it is often found in flocks of considerable size. Though I have never seen it in the fall, I have shot one specimen and seen others in the summer, so that it is quite probable that it sometimes breeds here.

14. *Bartramia longicauda* (Bechst.), Bartramian Sandpiper. Common summer resident in the higher parts of West Whiteland township, but I have never met with it elsewhere.

15. *Actitis macularia* (Linn.), Spotted Sandpiper. Common summer resident, mainly along the larger streams.

16. *Aegialitis semipalmata* Bonap., Semipalmated Plover. I shot two adult individuals in West Goshen, Sept. 12, 1888. These are, I believe, the only specimens taken in this county.

17. *Ae. vocifera* (Linn.), Killdeer. Common summer resident; arrives in the spring between March 2d and March 16th.

18. *Colinus virginianus* (Linn.), Bob-white. Infrequent resident in this vicinity, though it was more abundant ten years ago.

19. *Bonasa umbellus* (Linn.), Ruffed Grouse. I saw one May 10, 1890, in a thicket, a mile north of West Chester.

20. *Ectopistes migratorius* (Linn.), Passenger Pigeon. I shot one individual of this, now very rare, species, Sept. 1, 1886, in Birmingham township, and a female in West Goshen, Sept. 9, 1887. Both specimens were in immature plumage, and are now in the collection of the Acad. Nat. Sci., Philadelphia. I believe these to have been the last specimens taken in eastern Pennsylvania.

21. *Zenaidura macrura* (Linn.), Mourning Dove. Abundant summer resident. (Earliest arrivals: March 16, 1885; Feb. 22, 1886; March 3, 1887; March 24, 1888; March 14, 1889. Bulk arrived: March 26, 1886; March 30, 1887; March 31, 1888; March 29, 1889).

22. *Cathares aura* (Linn.), Turkey Vulture. Common through the spring, summer and fall; in mild winters a few are to be seen.

23. *Circus hudsonius* (Linn.), Marsh Hawk. Infrequent summer resident.

24. *Accipiter velox* (Wils.), Sharp-shinned Hawk. Infrequent; I have observed it only in the fall, winter and spring.

25. *A. cooperi* (Bonap.), Cooper's Hawk. Rather infrequent resident.

26. *Buteo borealis* (Gmel.), Red-tailed Hawk. Common resident; more abundant than any other hawk.

27. *B. lattisimus* (Wils.), Broad-winged Hawk. I shot an adult male in West Goshen, April 22, 1891.

28. *Falco peregrinus anatum* (Bonap.), Duck Hawk. I saw a specimen in the flesh, shot in East Bradford, Feb. 14, 1886. This specimen is now in the collection of Geo. W. Roberts, Esq., West Chester.

29. *F. columbarius* Linn. My brother shot a male in West Goshen, Oct. 25, 1885.

30. *F. sparvarius* Linn., American Sparrow Hawk. Common resident, though not remaining through severe winters.

31. *Pandion haliæetus carolinensis* (Gmel.), American Osprey. Infrequent; I have noticed a pair on several occasions during the summer of 1888, along the Brandywine (East Bradford). This pair might have been breeding in this vicinity. Is it not probable that many of those seen in this county have crossed over from New Jersey? (Earliest spring date, April 4, 1888).

32. *Asio acciptrinus* (Pall.), Short-eared Owl. A not infrequent visitant in the winter and early spring. I have never seen it in the fall. During some years it is more abundant than in others. I have

met with it on the following occasions: Feb. 17 to April 13, 1888; April 6, 1890; Jan. 8 to March 13, 1891.

33. *Megascops asio* (Linn.), Screech Owl. Common resident.

34. *Nystea nyctea* (Linn.), Snowy Owl. A few are seen or shot every severe winter, and I have seen such specimens in the flesh.

35. *Coccyzus americanus* (Linn.), Yellow-billed Cuckoo. Common summer resident. Arrives about the third week in May.

36. *C. erythrophthalmus* (Wils.), Black-billed Cuckoo. Summer resident, less abundant than the preceding.

37. *Ceryle alcyon* (Linn.), Belted Kingfisher. Common summer resident, remaining until about December. Arrives in the spring between March 15 and April 6.

38. *Dryobates villosus* (Linn.), Hairy Woodpecker. Infrequent in the fall, winter and early spring. I have never observed more than three or four in any one year. (Earliest fall occurrence: Sept. 10, 1887; latest spring occurrence: April 14, 1889).

39. *D. pubescens* (Linn.), Downy Woodpecker. Common resident.

40. *Sphyrapicus varius* (Linn.), Yellow-bellied Sapsucker. Rather common, though somewhat irregular, migrant in the spring (April) and fall (Sept. 28 to Nov. 21).

41. *Melanerpes erythrocephalus* (Linn.), Red-headed Woodpecker. Common summer resident, especially in the valley of the Brandywine; much less abundant on higher ground. (Earliest arrivals: March 11, 1886; April 28, 1891).

42. *Colaptes auratus* (Linn.), Flicker. Common summer resident, the most abundant representative of the family, with the possible exception of the Downy Woodpecker. (Earliest spring arrivals: March 7, 1886; March 23, 1887; March 24, 1888; March 27, 1889. Bulk arrived: April 3, 1886; April 10, 1887; March 31, 1888; March 31, 1889; April 15, 1891). One was seen by me Dec. 22, 1885.

43. *Antrostomus vociferus* (Wils.), Whip-poor-will. I heard one very plainly on April 27, 1891, in West Goshen township.

44. *Chordeiles virginianus* (Gmel.), Nighthawk. Rather common summer resident in certain dry and rocky localities, as, e.g., the "Barrens" in West Goshen. (Earliest spring arrivals: March 15, 1886; May 3, 1887; May 9, 1888; May 3, 1890. Bulk arrived: May 11, 1886; May 19, 1887. Remains in the fall until nearly October).

45. *Chaetura pelagica* (Linn.), Chimney Swift. Abundant summer resident. (Earliest spring arrivals: April 16, 1887; April 7, 1888; April 19, 1889: April 13, 1891. Bulk arrived: April 24, 1886; April 30, 1887; April 25, 1891. Leaves in the fall before Oct. 10).

46. *Trochilus colubris* Linn., Ruby-throated Humming-bird. Rather common summer resident. (Earliest spring arrivals: April 14, 1886; May 9, 1887; May 17, 1888; May 2, 1897).

47. *Tyrannus tyrannus* (Linn.), Kingbird. Common summer resident. (Earliest spring arrivals: April 2, 1885; April 7, 1886; May 4, 1887. Bulk arrived: May 5, 1887; May 9, 1888).

48. *Myiarchus crinitus* (Linn.), Crested Flycatcher. Common summer resident, though not as abundant as the preceding. (Earliest spring arrival: May 3, 1890. Bulk arrived: May 7, 1887).

49. *Sayornis phoebe* (Lath.), Pewee. Abundant summer resident. It arrives in the spring much earlier than the other flycatchers. (Earliest spring arrivals: March 29, 1886; March 27, 1887; March 23, 1889; March 16, 1890; April 8, 1891; March 23, 1895. Bulk arrived: April 3, 1886; April 21, 1887).

50. *Contopus virens* (Linn.), Wood Pewee. Abundant summer resident, more numerous than the preceding species. (Earliest spring arrivals: April 17, 1886; April 28, 1891. Bulk arrived: May 7, 1887).

51. *Empidonax flaviventris* Baird, Yellow-bellied Flycatcher. Infrequent if not rare migrant in the fall. I have secured only three or four specimens, but have seen others in the collections of local ornithologists.

52. *E. virescens* (Vieill), Acadian Flycatcher. An infrequent migrant in the spring.

53. *E. minimus* Baird, Least Flycatcher. Infrequent migrant. I shot three specimens and saw another in the month of May (1890, 1891), but have never seen it in the fall.

54. *Cyanocitta cristata* (Linn.), Blue Jay. Common resident in thick woods along the Brandywine, less frequent in higher localities. In the winter it is also found in the open country.

55. *Corvus americanus* Aud., American Crow. Abundant resident, though some appear to migrate in severe winters.

56. *Dolichonyx oryzivorus* (Linn.), Bobolink. Common, occasionally even abundant, migrant in the spring and fall. In the former season it is found almost exclusively along the Brandywine, but in the fall is frequently met with also in the uplands, in clover fields. (I have the following notes on its occurrence. Spring: May 11–20, 1896; May 5–17, 1887; fall: Aug. 4–29, 1886; Aug. 8, 1889; Sept. 25, 1890).

57. *Molothrus ater* (Bodd.), Cowbird. Abundant summer resident. (Earliest spring arrivals: March 13, 1887; March 14, 1889; March 15, 1891. Bulk arrived: March 24, 1887; April 4, 1888; March 23, 1889).

58. *Agelaius phœniceus* (Linn.), Red-winged Blackbird. Abundant summer resident. (Earliest spring arrivals: March 8, 1887; February 22, 1888; March 12, 1889. Bulk arrived: March 13, 1887; March 17, 1888; March 23, 1889).

59. *Sturnella magna* (Linn.), Meadow Lark. Abundant resident. During mild winters large numbers may be found in sheltered valleys, while in severe winters, as was 1895, few are to be seen. I can corroborate the fact noticed by other observers that this species in the cold season always migrates, to a certain extent, by leaving the higher ground to collect in the valleys.

60. *Icterus spurius* (Linn.), Orchard Oriole. Rather common summer resident, but less abundant than the following species. (Earliest spring arrivals: May 4, 1887; May 3, 1890. Bulk arrived: May 7, 1886; May 5, 1887; May 6, 1888).

61. *I. galbula* (Linn.), Baltimore Oriole. Common summer resident. (Earliest spring arrivals: May 5, 1886; May 1, 1887; April 29, 1888; May 9, 1891. Bulk arrived: May 7, 1886; May 4, 1887).

62. *Scolecophagus carolinus* (Müll.), Rusty Blackbird. Saw a single individual, Nov. 22, 1896.

63. *Quiscalus quiscula* (Linn.), Purple Grackle. Abundant summer resident. (Earliest spring arrivals: Jan. 2, Feb. 10, 1887; Feb. 20, 1888; March 2, 1889; Jan. 29, 1890; Feb. 2, 1891. Bulk arrived: March 8, 1887; Feb. 26, 1888; March 1, 1890; Feb. 24, 1891. Latest occurrences in the fall: Nov. 25, 1887; Dec. 20, 1889).

64. *Q. quiscula æneus* (Ridgw.), Bronzed Grackle. I have a single specimen in my collection, taken in East Bradford, April 30, 1889.

65. *Carpodacus purpureus* (Gmel.), Purple Finch. I have personally observed this bird only in the year 1887, when I saw a number of small flocks from April 26th to May 9th. According to West Chester papers, they were observed also in the following spring. It would seem to be an irregular spring migrant in this locality.

66. *Loxia curvirostra minor* (Brehm.), American Crossbill. Infrequent winter resident. I have found it on only two occasions, but Mr. Josiah Hoopes has collected it quite frequently in the Hoopes' Nurseries, West Goshen.

67. *Acanthis linaria* (Linn.), Redpoll. Irregular visitant in exceptionally cold winters. I have seen it only once, on March 24, 1888, when I noticed a flock of about a dozen.

68. *Spinus tristis* (Linn.), American Goldfinch. Abundant resident, though large numbers migrate in severe winters.

69. *S. pinus* (Wils.), Pine Siskin. Irregular winter visitant. I have seen it twice, a single individual, on Feb. 5, 1888, and a small flock on

the 22d of the same month. I also noticed a flock of about 30 in our apple orchard, from April 28 to May 7, 1897, and shot several individuals.

70. *Poocaetes gramineus* (Gmel.), Vesper Sparrow. Abundant summer resident. (Earliest spring arrivals: April 5, 1887; March 31, 1888; March 28, 1889; April 13, 1891; March 29, 1895. Bulk arrived: April 6, 1887; April 1, 1888; April 4, 1889; April 19, 1890).

71. *Ammodramus sandvichensis savanna* (Wils.), Savanna Sparrow. Abundant migrant in the spring and fall. (Spring occurrences noted: April 8–13, 1886, March 28, 1889; April 19, 1890; April 18 to May 9, 1891).

(*To be continued.*)

**On the Use of the Terms Heredity and Variability.**—Recent discussions of various biologic phases of evolution have become so refined that our attention must be more critically given to the exact meaning which each writer gives to the terms he uses. Each author, having some special point to emphasize, gives his own particular definition to common terms, and so makes a direct comparison of his propositions with those of other writers impossible. A great deal of time-patience-consuming controversy finds room in mere quibbles of words without essential disagreement of ideas. Even the terms "heredity" and "variability," standing for the very foundation blocks of evolution, suffer seriously from this duplicity of definition.

It has long seemed to the present writer that considerable polemic friction could be avoided without a re-definition of these two important terms if the relationship of the two notions were more accurately and generally apprehended. Heredity and variability are so commonly placed in antithesis that we unconsciously assume that they express qualitative differences. But they do not. In relation to each other their significance is purely quantitive. In the quantitive scale they designate supplements. If one race manifests variability more than another it manifests heredity by so much less. If variability increases in a variety heredity wanes. If the inheritance of likenesses becomes more marked we say that variation is growing less; our variety is becoming "fixed." Thus heredity and variability really stand to each other as heat and cold,—as positive and negative. And a perfectly accurate nomenclature could dispense with one or the other. But while both terms are still conveniently retained, as are the terms heat and cold, it is extremely desirable that their unity of application be observed.

If this complimentary nature of heredity and variability were more keenly appreciated many evolutionary misunderstandings would be

forestalled at their very beginnings. Thus it has been usual for philosophers, like Lamarck, Nägeli and Eimer, to assume that the exact reproduction of likeness was the original characteristic of organic reproduction, and that variability is an anomaly to be accounted for. This is now met by Bailey's contra-assumption that unlikeness marks all unsophisticated reproduction, and that "heredity is an acquired character." Both are equally assumptions and equally gratuitous. What we actually *know* is that among different races the average degree of likeness between successive generations differs. We also know that the degree of likeness fluctuates from generation to generation in the same race. We do not know of such a thing as absolute likeness, nor do we know the complete absence of heredity. The only thing that we do know is that similarity begets similarity. That like begets like, or unlike begets unlike can be true only by a quibble of the terms.

In dealing with this subject in a very critical class of students we have so much felt the need of more precise nomenclature that I have given the name of the allophysical law to the formula "similarity begets similarity." Heredity is then retained in its absolute sense (the sense in which it is actually most used) as a convenient zero-point from which to measure variability. But the normal cause of reproduction is not conceived to be the repetition of exact likenesses, nor of total unlikenesses, but is understood to follow the allophysical law.—F. A. WAUGH.

**Zoological News.**—According to Mr. E. H. L. Schwartz, Spirula is in its anatomy closely related to Sepia. As to its descent the author finds that it has been derived from the Belemnites through Spirulirostra, thus reversing the process set forth in an authoritative article recently published. Mr. Schwartz bases his conclusions upon the study of sections of the shell passing through all the whorls in the plane of coiling, whereby the structure of the walls and septa are well exposed. (Journ. Marine Zool. and Micros., Vol. II, No. 6.)

Nineteen species and subspecies of Voles are recognized by Mr. Bailey as inhabiting Canada and the United States. Of these, five are described as new. Concerning the habits of these animals the author states that they do not hibernate in winter, nor has he ever found evidence of their storing provision. They make long tunnels under the snow, through which they travel about in safety while they procure the tender grass blades and ripe seeds as easily from the surface of the ground as when the white blanket is not above them. (Proceeds. Biol. Soc. Washington, Vol. XI, 1897.)

A late number of the Proceeds. Phila. Acad. contains an anatomical description of *Tarsius fuscus*, by Dr. Harrison Allen. The author describes the superficies, auricles, rugæ, bones and muscles and compares them with the account of the corresponding parts in the allied species *Tarsius tarsius* as given in Burmeister's monograph. Dr. Allen goes into some detail which is lacking in Burmeister's paper, notably full descriptions of the teeth, with figures; and notes on the mechanism of the limbs. (Proceeds., Phila., Acad., 1897.)

## ENTOMOLOGY.[1]

**Miss Ormerod's Report.**—A perusal of Miss Ormerod's recent report on the injurious insects of Great Britain for 1896, shows that the insect pests on the other side of the Atlantic differ but little from their cousins here in their methods of attack. In fact, in many instances they are identical, portions of the report treating of the codlin moth (*Carpocapsa pomonella*), Asparagus beetle (*Crioceris asparagi*) and several other only too common American insects. There are numerous injurious insects, however, at present confined to the Old World, many of which in time are likely to gain foothold here, and against the introduction of which we cannot be too careful. Notice the devastation wrought by the common cabbage butterfly (*Pieris rapæ*) which in a few years after its introduction had spread from the Atlantic to the Pacific, and yet in England it is usually considered as of minor importance compared with its larger relative *Pieris brassicæ.* The gypsy moth is another example of the alarming spread of an insect in a new country when unchecked by its natural enemies. Hundreds of thousands of dollars have been spent by Massachusetts in an endeavor to eradicate it after it had gotten a strong foothold, all of which might have been saved had the attempt been made in time. And now according to the newspapers another undesirable emigrant has arrived on the scene in the form of the "brown tailed moth" and established itself in the very midst of the gypsy moth infested region in a strip a "mile long by half a mile wide" in which it has "stripped the most of the fruit and many of the shade trees." The insect from its life history would seem to be an easy enemy to fight and should it be as dangerous as reported will probably be stamped out with little trouble unless it has a greater range than was supposed. But if the few people who noticed it in pre-

[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

vious years had but had a knowledge of entomology, who knows what might have been saved.

The Twentieth Report shows the same painstaking care in its preparation that have characterized its predecessors. It has as a frontispiece a half-tone portrait of the author's sister, Miss Georgiana E. Ormerod, who so long collaborated in the entomological work, and who died during the year. American entomologists generally have felt much sympathy for Miss Ormerod in this loss and will read with interest the touching tribute in this report.

A large number of insects are treated of by the author of the report, and several new illustrations embellish its pages.

**Lepidoptera.**—Under the names Ptilodontidæ and Melalophidæ, Mr. Harrison G. Dyar[2] has made a generic revision of the North American, European and Indian members of that group of moths until recently known as Notodontidæ. He separates the two groups or families on larval characters. The lowest genera (*e. g.*, Gluphisia) present "smooth larva with simple setæ; others have variously humped or otherwise modified bodies. Then follows a group in which the moths tend to lose the tongue although not sharply marked off by this character. The larvae, however, are hairy, that is they have developed warts and secondary hairs. The wart formation is peculiar being characterized by three warts above the stigmatical wart on the thorax, and thus contrasting with the parallel wart formation in the Arctiid allies, another great branch of the Bombyces. At first all the warts are in line but soon we reach forms (*e. g., Apatelodes*) in which the central wart is moved back out of line. At this point a large group of moths in India, has diverged from the type losing one vein of the fore wings. These are the true Eupterotidæ and form the highest group of the Ptilodont allies. The line is, however, almost directly continued by the European genus Lemonia (frenulum gone) into the Lachneidæ (cubitus 4-branched), the larva remaining true to type but becoming gradually more specialized to culminate in the Lachneids." The Eupterotidæ are not treated of in the revision. As may be seen the first division is much the larger, but the second contains such well known forms as Datana, Melalopha (Ichthyura) and Apatelodes.

**McNeill on Tryxalinæ.**—The Davenport Academy of Natural Sciences, has just published in an octavo pamphlet of 96 pages and six admirable plates, Prof. J. McNeill's Revision of the Tryxalinæ of North

[2] Transactions of American Entomological Society, XXIV, 1–20.

America. It is one of the most important pieces of recent work done on the North American Orthoptera by American entomologists; for the Tryxalinæ have been one of the least known though richest groups. The classification is an independent one and does not follow very closely Brunner's general outline of the Tryxalinæ of the world given four years ago, and which contains a relatively small proportion of the genera recognized by McNeill. Altogether 75 species are entered, referred to 31 genera of which 11 are proposed as new. Only ten new forms are described which is an astonishingly small number for the country since several new forms have been found in the East within recent years and a great deal remains to be done even here. A full figure, generally with considerable additional detail, is given for each genus, but unfortunately the enlargement above nature is not indicated. This memoir places our small grasshoppers on a very different basis from that on which they stood before and the figures alone are a striking addition to our means of study and determination.—*Psyche*, Vol. VIII, No. 352.

**John L. Curtis.**—Mr. John L. Kellogg in the Entomological News for April, 1897, in a sketch of the life of John L. Curtis says:—"The name of Mr. Curtis is not familiar to entomologists but I wish that some particulars of the brave life of this student of entomology, may be known to those whose attention may be arrested by the unknown name.

"John L. Curtis, of Oakland, Cal., died at twenty-five. During the twelve years preceding his death, his waking hours were passed in a wheeled chair. A paralytic affliction deprived him of the use of the muscles of body, legs and arms except those of his wrists and hands. His consolation and delight were found in the study of Natural history. After caring for and watching a solitary spider kept in confinement for several years, he began with earnest zeal the careful study of spiders. His friends sent them to him in such numbers that at times, he had sixty or seventy species under observation. Wheeled by a companion along hedge-rows he observed them in their natural homes and collected them. After three years of delighting, absorbing study his eyes so failed him, that he was limited during two years to one half hour a day to microscopic or minute examination. In the last two years of his life, his health failing constantly, he devoted himself exclusively to the observation of the new spider described elsewhere in the News. He devised ingenious methods of feeding, housing and watering his spiders. He made exhaustive observations of their every habit and recorded all in

notes and drawing. Untrained, inert, helpless, tortured, his patient enthusiastic devotion to his studies, has enabled him to add something to our knowledge of living things and to find for himself happiness in the midst of affliction."

The description of the new spider is given in the same number and the substance of part of the author's notes in the species. Probably no species of insect has ever been described with such copious notes as to its life history and habits as in this case.

**Hemiptera.**—Mr. B. M. Duggar[3] has made a study of a bacterial disease of the Squash bug (*Anasa tristis*), and publishes a series of experiments on the inoculation of other insects with the culture.

The toxic properties of the bacillus were very marked. From one of the early isolation cultures several colonies of the disease bacteria were removed, " and diffused in a small quantity of distilled water to serve some inoculation purposes. On immersing young squash bugs in this solution death followed almost instantly.

With nymphs somewhat older the effect was not so rapid but the bugs soon succumbed. Young chinch bugs, flies and other insects stiffened as if dead on being immersed from one to several minutes. Many of the hard shelled insects if removed immediately on becoming rigid recover in a few minutes sufficiently to crawl away; but even these die if immersed in the solution for a longer time."

Messrs. Herbert Osborn and E. D. Ball[4] have published the results of a study of the life histories of the grass feeding Jassidæ. The more general results of their investigations show that so far as known all species deposit eggs upon the stem under the leaf sheaths of the plants used as food, and that the species have as a rule decided limitation as to food plant, but that the adults are more general feeders. Some of the species have but one brood, others two and still others three in a season and the ordinary life of a brood does not exceed two months. Some twenty-four species are noted as injurious to grass, several of which are undescribed. Technical descriptions of hitherto undescribed forms will appear in a forth-coming paper in the Proceedings of the Iowa Academy of Natural Sciences.

Mr. J. B. Smith[5] has made notes on the life history of the harlequin cabbage bug and melon plant louse (*Margantia histrionica* and *Aphis gossypii*) with preventive and remedial measures.

[3] Bull. Ill. State Lab. of Nat. History, IV, 340–379.

[4] Bull. 34, Iowa Agri. Expt. Station.

[5] New Jersey, Agri. Exp. Sta., Bull., 121.

**Alternation of Generations in Cynips calicis.**—A recent paper by Prof. M. W. Beijerinck in *Archives néerlandaises d. sci. ex. e. nat.* (tome XXX, livr. 5) brings to light a very interesting case of alternation of generations in the genus Cynips as restricted by Mayr. *Cynips calicis* is a large agamic gall fly, produced from a rather large irregular gall on the acorns of *Quercus pedunculata*. This gall is rich in gallic acid and is of commercial importance in parts of southeastern Europe. In begins to develop in May, falls to the ground in autumn, and does not decay for several years. A portion of the flies come out at the end of the first winter and the remainder at the end of the second winter. The fly which emerges from this gall is incapable of producing it. The eggs of *Cynips calicis* are not deposited on *Quercus pedunculata* at all, but on another species of oak, *Quercus cerris*. *Cynips calicis* emerges in March and at this time the acorns of *Q. pedunculata* do not exist even in embryo, and are not in condition for eggs to be deposited in them until fully two months later. The eggs of *Cynips calicis* are deposited in the young anthers of *Quercus cerris* and from this oviposition results a conical tiny, hasty gall, very easily overlooked. Out of these galls in about two months emerge tiny, smooth gall flies, male and female, which belong to the genus Andricus. These flies immediately pair and the females at once deposit their eggs on the now ready young acorns of *Quercus pedunculata*, and around these develop the large galls of the *Cynips calicis*. The author was led to these discoveries by the fact that *Q. pedunculata* bears no galls of *Cynips calicis* in the Netherlands except when an occasional tree of *Q. cerris* happens to have been planted in the vicinity of the other species. His observations and experiments cover a period of several years, and there seems to be no doubt of his having proved his points. It is suggested that the galls of *Cynips calicis* might be made commercially important in the Netherlands by generally planting *Q. cerris* in the groves of *Q. pedunculata*. Of course, the thought lies very near that other species of Andricus simply represent the sexual stage of species of Cynips.—ERWIN F. SMITH.

**General Notes.**—Mr. F. H. Chittenden[6] has prepared a collection of articles on little known insects affecting stored vegetable products. Notes are given on a number of insects, some of which are previously unrecorded from America, and may prove decidedly injurious in the future.

[6] U. S. Dept. of Agri., Div. of Entomology, Bull., No. 8—New Series.

Mr. Claude Fuller[7] of the Technological Museum, Sydney, has described and figured a very peculiar gall from a common Australian plant, which bears a striking resemblance to a caterpillar with its head and anterior parts of its body thrown back in an " attitude of defense." Neither " beetles nor inquilines seeking a suitable rearing ground for their young would be attracted by a caterpillar," thus protecting the inhabitants from injury from that source and though " insectivorous and predaceous birds might be attracted by it, they would at once be repelled by its woodiness while small wood pecking species, which might prey on its inhabitants would seldom be attracted by its appearance."

Dr. Otto Lugger[8] has prepared an extended report of the insects injurious in 1896, and of the parasites of man and the domestic animals.

## EMBRYOLOGY.[1]

**Breeding Habits of the Spotted Salamander.**—The instincts and habits connected with the process of fertilization in the tailed amphibia are so remarkable, that even a few imperfect observations on these processes in our common salamander (*Amblystoma punctatum*) seem worth recording in the hope of aiding in some future comparative study that may throw light upon this puzzling chapter in Natural History.

Since Gasco[2] and Zeller[3] showed that the European triton and several other salamanders have an internal fertilization and yet no copulation, Jordan,[4] and also Gage,[5] have described much the same series of events in our common newt (*Diemyctylus viridescens*), while Ritter[6] has recently found similar phenomena in the western newt (*D. torosus*).

[7] Agricultural Gazette of New South Wales, VII, 697.

[8] Minnesota, Agr. Exp. Sta., Bull. 48.

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Gli amori del tritone alpestre, Geneva, 1880, and Les amours des Axolotyls. Zool. Anz., IV, 1881.

[3] Ueber die Befruchtung bei den Urodelen. Zeit. f. wiss. Zool., 1890, XLIX.

[4] Spermatophores of Diemyctylus. Journal of Morphology, V, 1891; and Habits and Development of the Newt. Idem., VIII, 1893.

[5] Life History of the Vermillion-spotted Newt. AMER. NAT., Dec., 1891.

[6] Diemyctylus torosu. Proc. Cal. Acad. Nat. Sci. Zool., Vol. 1, Jan. 18, 1897.

From the excellent and detailed accounts given by Jordan we learn that during great sexual excitement the male clasps the female firmly for a long time; then the animals separate and a remarkable procession follows, the male going in advance deposits sperm in special cases, spermatophores, which are taken up by the female and subsequently used in fertilizing the eggs before they are laid, that is, the sexual embrace does not lead to transfer of sperm directly, but to subsequent deposition of spermatophores that are gathered up by the female. These spermatophores are small gelatinous masses containing sperm, and are taken into the cloaca of the female as she walks over them.

Apparently much the same series of events takes place in the breeding of Amblystoma. About Baltimore the eggs of this large salamander are very abundant in March and even in February in small pools in the woods, but the adults are then rarely seen. Since 1878 and '79 when F. S. Clarke[7] succeeded in obtaining a male and a female and saw the eggs deposited in captivity, the adults have very rarely been taken at the breeding season. Even when small pools, but four feet wide and nine inches deep, were thoroughly raked out before and after the eggs appeared, no adults were found, so that it was inferred that the laying takes place in the night and that the adults may even leave the water every day to conceal themselves under stones, etc. But this spring Mr. M. T. Sudler found a female moving away from a bunch of eggs early in the morning. This specimen kept isolated laid many eggs, and as these developed into normal larvæ, the existence of internal fertilization was proven.

In these small pools the laying of amblystoma eggs was preceded by 24 hours or so, last year and this, by the occurrence of white specks formed in lines on the dead twigs and leaves covering the bottom. These objects were quite conspicuous when the water was clear, and were at first thought to be some fungus growths from dead twigs, but on examination proved to be gelatinous pyramids or irregular cones of clear material bearing globoid, opaque, white enlargements at the tips. Each was about one half an inch high and firmly attached to a dead twig or leaf, generally at the edge of the latter as might be the case if put down from the clasping lips of the cloaca of Amblystoma. Distributed at intervals of a few inches they formed lines of several to a dozen. Microscopic examination showed the opaque tips to be a mass of coiled, densely packed filaments, highly refracting and at first sight apparently with no ends, yet appropriate stains differentiated the essen-

[7] The Development of *Amblystoma punctatum*. Studies Biol. Lab. J. H. U., Vol. I, Baltimore, 1879.

tial parts of spermatozoa and showed that these threads might well be the very large sperms of Amblystoma, seen and measured by S. F. Clarke. These masses thus agree essentially with the spermatophores of other tailless amphibia; they are more slender and higher than those of Diemyctylus, but built on the same general plan, and much less complex in form than those of the European triton.

Though it is most probable that these bodies are the spermatophores deposited by the male Amblystoma before the female lays the eggs, yet it is, perhaps, possible that they may yet prove to be but preliminary attempts at egg laying; the female depositing some sperm within such secretion as is normally formed about the eggs. But this latter assumption seems scarcely tenable.

We may conclude: (1). Fertilization in *Amblystoma punctatum* is internal (at least in the case observed). (2). Sperm-containing masses are often deposited before the eggs are laid; these are probably spermatophores put down by the male. (3). We may infer that the female gathers up the sperm from some of the spermatophores and that through this act the eggs are fertilized.—E. A. ANDREWS.

**Cell Division and Nuclear Division.**—Boveri[8] has repeated his notable attempts to fertilize non-nucleated pieces of the eggs of one species of sea-urchin (*Echinus tuberculatus*) with the sperm of another (*Strongylocentrotus lividus*) and finds incidentally some remarkable illustrations of the independence of nucleus and centrosome, and of the connection between the nucleus and cell division.

In most cases where only one sperm enters such a non-nucleated piece of egg of another species the first cell division results in forming two masses—one with all the nuclear matter of the sperm the other with one centrosome and no nuclear matter. The mass with the nucleus continues to divide and forms a small blastula that may live three days. The other does not divide but remains as a single mass adjacent to the dividing cell; inside it, however, the centrosome does divide and with the *same rhythm* as in the first mass, so that there are ultimately a large number of centrosomes and stars in a single cell or non-nucleated, undivided mass.

In fact the centrosomes go through all the phases they would in cell division, though the nucleus is absent!

Various facts and considerations lead the author to think it likely that the mitotic phenomena are started by conditions of the protoplasm that affect both the centrosome and the nucleus and lead them to go through their characteristic changes, independently of one another.

[8] Ph. Med. Verein, Wurzburg. Oct., 1896.

From the behavior of eggs that are entered by two or more sperms the author concludes that cell division does not take place without nuclear division. In these cases, at least, the egg divides into two, or into four cells or *partly* divides according as the asters have a nuclear spindle between them or not.

Moreover it is not the mere presence of the nucleus that is necessary for cell division but the nucleus must be connected with the centrosomes.

**Visible Complexity of Protoplasm in Certain Eggs.**—The great advances which have been made since the days when the nucleus of an egg was spoken of as a mere vesicle with one or more "spots" in it are well illustrated by the elaborate study made by the Abbé Carnoy[9] with assistance of H. Lebrun.

With remarkable patience, skill and trained imagination M. Carnoy has unraveled the complexities of structures seen in many thousands of sections of the eggs of certain salamanders and gained by ten years of labor a coherent conception of the successive changes these eggs undergo. The beautifully executed drawings that accompany the memoir show most remarkable arrangement of "chromatin" or staining material within the nucleus; the nucleus appears as a sphere of most complex and changeable structure—even the "spots" or nuclei within it having more complexity of structure than can be seen in many whole nuclei.

The paper describes the appearance of the egg nucleus at successive stages while it is growing ripe in the ovary. Chiefly *Salamandra maculosa* Laur. and *Pleurodeles Waltlii* Mich. served for material.

In the former, fertilization takes place about the first of July; the young are born alive the following Spring and leave the water towards September. The eggs in these young are about 200$\mu$ in diameter with a nucleus 110$\mu$ the end of the following May. The second May the eggs are 500–600$\mu$ and the third May, 1400. Not till the end of June, of the following year are they ready for fertilization; then they are 3500–3700$\mu$. The eggs then require more than three years to develop and the females are about five years old when first ready for copulation.

As the egg enlarges during about three years the nucleus exhibits the successive changes described in outline below.

In the young ovarian eggs 30$\mu$ in diameter the large nucleus (18$\mu$) contains a conspicuous filament of chromatin, which appears as a closed loop with no free ends. Besides this the nuclear sap is also resolvable into a very fine network of plastin (linin of some). This chromatic filament breaks up and parts of it remain as *nucleoli.* The nucleoli are thus all chromatic and not plasmatic in origin.

[9] La Cellule XII. Feb. 1, 1897, pps. 191–292, pls. 6.

It is subsequent changes in these nucleoli that constitute the remarkable, complex figures seen in the numerous illustrations.

The part of the original nuclear filament not concerned in forming nucleoli becomes *resolved* into innumerable minute granules. These granules arise from the filament in various ways somewhat as do similar granules from the nucleoli, as described below. The granules disperse in the nuclear sap, but not without reference to the pre-existing structure of that sap, in fact they seem to travel out along the strands of the plasmatic network. Ultimately these granules dissolve and the filament is henceforth represented only by the nucleoli.

We come thus to a stage in which the nucleus contains no visible objects except the chromatic nucleoli and the fine plasma net. The nucleoli, as they formed from the filament, went out to the periphery of the nucleus to lie near its membrane. They next begin a migration inwards towards the central part of the nucleus and enlarging become *resolved* into remarkable figures. These figures are different in successive years and even in different animals and much of the labor of the authors has been the attempt to arrange the large mass of material in some classified order.

These figures continue to be found all through the growth of the egg; *successive generations of nucleoli arise and are resolved into figures.*

Many of the figures would be taken for arrangements of chromatin directly arising from the original loop—others seems strange and bizarre.

Any continuity of chromatin seems here out of question, except as the nucleoli first arise from chromatin and subsequently are continued as successive generations of chromatic figures; any attempt to trace continues chromatic bodies, chromosomes—seems most impossible.

We cannot attempt in the limit of a short abstract to mention the numerous shapes the nucleoli assume in the process of resolution. Starting from the form of a spheroidal, apparently homogeneous body the nucleolus may swell up into a spongy mass that transforms into a large network of complex strands, each composed of innumerable granules. Or the nucleolus may branch out into plume and brush-like figures, often resembling a test-tube-or lamp-chimney-cleaner. Other nuclei form branching trees, coiled filaments, groups of balls with filamentous connections, stars and radiating masses looking like spattered paint.

Some of the figures are found only at certain periods of the year others in various stages of the development of the egg; some periods are characterized by the occurrence of only one form of figures while others have a prevailing form and others a mixture of many forms.

The time taken to form the figures cannot be determined, but apparently the various generations of nucleoli follow rapidly, each being resolved into the figures and the figures forming granules and the granules dissolving into the material that presumably dissolves away into the cell protoplasm to help form the yolk.

The successive generations of nucleoli arise from preceeding ones; the first nucleoli come as stated above from the original chromatic filament, the following generations arise from the *granules*, into which the nucleoli disintegrate—some granules not dissolving but persisting; later some nucleoli arise from *spherules* or larger fragments of figures that do not break down into the minute granules. In either case the new nucleoli arise near the nucleolar membrane; in the first case from many granules that become enveloped by a membrane in the second case by the union of several spherules or else by the enlargement of a single spherule.

Now the granules are arranged along the plastin network and when many combine to form a new nucleolus that nucleolus is a structured and complex body having in it a network with granules and an outside membrane. Though the nucleolus looks homogeneous yet actual sections of nucleoli may show the outside membrane, the plastin network and the granules or filaments of chromatin: in *fact the nucleolus has the same structure as the nucleus.* This is seen in section and again when the nucleolus passes into the interior of the nucleus to be resolved into some complex figure; it may then even come out of its membrane and, as it were, grow out in a tree like net with chromatin on the meshes.

Before speaking of the interesting descriptions of the formation of yolk, outside the nucleus, we may venture to restate the above brief outline of the process of resolution of nucleoli in comparing it with a complex series of pyrotechnic displays. The nucleoli are like most complicated fireworks arranged about the periphery of the nucleus—apparently simple but complex in internal arrangement. They move inwards towards the centre of the nucleus—as if discharged and then unfold the most diverse stars, feathers, coils, nets, etc., that ultimately burst into the smallest sparks, granules, scattering outwards through the nucleus along the network of plastin that fills the entire area. When most of these sparks are quenched some few are coming together near the old point of discharge and fashioning a complex rocket, Roman candle, or wheel that will in turn be set off at the succeeding display of figures—and so on for several years.

Thus innumerable granules are formed and dissolved, few keeping intact to form the next generation. One result of the great manufacture of granules is, the author conceives, the formation of yolk in the egg.

The yolk begins to appear when the egg is only 300$\mu$ in diameter and grows to be the large mass of crystal-like bodies familiar in the eggs of Amphibia. The first perceived change in the egg protoplasm is the occurrence of minute areas near the cell periphery; areas which include a considerable number of the spaces of the plastin network and become recognizable from the rest of the network by a difference in refraction, looking as if the spaces of the net were filled in by solid albumen. Such changed areas ultimately fuse together to form a zone in peripheral part of the egg and as the yolk increases this zone extends in toward the nucleus, more and more. In one of the small areas there appear exceedingly minute granules along the lines of the net—these are the young yolk granules that enlarge as if small crystals growing in a solution. This solution is thought to be furnished by the combined activity of nucleus and egg protoplasm; the nucleus furnishing paranucleic acid and the egg protoplasms the globulins; these combining make paranuclein and then vitilline—the yolk granule. The generations of figures in the nucleus form granules of nuclein that dissolve and by hydrolosis the nucleic acid is set free—this becomes the paranucleic acid that is supposed to soak out through the cell to the region where yolk is to form. However this may be, the granules of yolk enlarge and appear scattered in stout strands or cords of protoplasm that run amongst vacules or water spaces in the egg. Hitherto there have been no vacules in the egg and the author denies that there is anything comparable to the foam-structure of Büschli; the vacules that now appear are, he thinks, due to the absorbtion of water by the globulins. The vacules may become large and be subdivided by strands of protoplasm going across them. The water thus collected is later seen in deeper parts of the egg towards the nucleus and the egg thus takes on a *spongy* structure as the yolk develops. The minute yolk granules move centrally from this first place of origins in the strands amidst the vacules and now get into the spongy protoplasm; here each one may get into a watery vacule and grow to its definition size and form. The yolk granules thus start in the plastic net and end in a vacule; how this change is brought about is not evident from the author's account.

The interesting introductory statement and the author's views upon the centrosome question cannot be reviewed here as they do not bear directly upon the present subject.

## PSYCHOLOGY.[1]

**Rapid Calculators.**—In 1894 Prof. Binet published an elaborate series of tests made on two well-known "lightning calculators," Diamandi, a Greek, and Inaudi, an Italian. A notable result of these tests was to show that while one of the pair, Diamandi, was of a visual type, like most professional calculators, the other, Inaudi, was exceptional in being auditory. Thus while the former committed numbers to memory more readily when they were written out, and was able to repeat a square of figures, once memorized, by rows or columns with equal facility, the latter learned numbers more rapidly when they were given orally, or by speaking them himself, and found it difficult to repeat them afterwards in any other order than that in which he had committed them. Inaudi always accompanied his calculations by slight lip and throat movements, and when asked to make a constant and uniform sound during his work, declared himself wholly unable to perform the required operations.

These observations have recently been supplemented by a monograph study by Sign. Guicciardi and Ferrari[2] of an Italian, Ugo Zaneboni, who has lately been giving exhibitions of his skill as a calculator. They found him to be visual in type, like Diamandi, with whom, however, he could not compare for speed and versatility.

The most noticeable point about Zaneboni is the wide difference between his power of acquisition and his power of retention. In the former respect he is decidedly mediocre. Thus he required nearly seven minutes to memorize a series of 25 numbers, which he was told were to be repeated by him the next day; the next day he was unable to give more than the first four correctly. On the other hand, his power of retention was extraordinary. Its material appeared to be supplied by an automatic process of acquisition, since voluntary memorizing on his part was possible only by a distinct effort of the attention. During his years of military service, Zaneboni was frequently posted at a railroad station. He spent his spare time there in reading and re-reading the time-tables; as a result he is now able to give correctly from memory the distances between any two places in Italy, with the fares for each class. At another period in his life he memorized a list of 227 cities, Italian and foreign, with their population, which he uses in his public

[1] Edited by Howard C. Warren, Princeton University, Princeton, N. J.

[2] Rivista Sperim. di Freniatria, 1897, XXIII, fasc. 1 and 2.

exhibitions; e. g., the figures representing the population of any two of these cities being given him, combined into a single number and in any order, he will give the names of the cities. He has also committed to memory a large number of squares, cubes, etc., up to the fifth power, as well as many products of two-place numbers; i. e., his multiplication table extends with some breaks to 100 x 100, instead of 12 x 12. With the help of these known solutions he is able to perform arithmetical operations with great rapidity; he recognizes perfect squares, cubes, etc., at a glance, and in performing multiplications breaks up the given numbers into parts with whose products he is already familiar. His power of retention is the sole source of this facility in calculation; he has no special aptitude for performing the operations themselves. This was clearly demonstrated by a comparison of his time with that of Diamandi and Inaudi, in the tests made on this point. In the simpler operations, involving results with which he was familiar, his time was but slightly longer than theirs; but as the task grew more complex and the numbers required more breaking up into factors according to his method, his time increased to double and sometimes even four times theirs. The tests of addition, subtraction, multiplication and division given him were identical with those given to Inaudi by Prof. Binet, so that their respective results admit of direct comparison here. The other calculators seem to have had some natural facility in handling new problems, or at least new examples of old problems: with Zaneboni the only special gift was a memory for numbers, and that was a retaining, not an acquiring aptitude.

Another point of interest in Zaneboni was his visual type. This characteristic revealed itself in several ways. In his public exhibitions he preferred to have the numbers written out on the board, rather than spoken. His visual reactions were short from the first, and very constant ($205\sigma$). He was able to read eight figures shown by an instantaneous electric flash, while ordinary individuals were only able to distinguish three or four under the same conditions. Out of 50 words, selected from widely different spheres as a test for association, 35 gave visual associations in his case, and of the remainder 9 failed to call forth any association whatever. All these tests combined to demonstrate the essentially visual character of his ideational processes.

Like most other professional calculators, Zaneboni's interest centers wholly in his profession; beyond it he has no tastes and little general knowledge. "He rises shortly before noon, walks a little, dines at two, then walks again or goes to some café, and about seven o'clock goes to the theater. After the performance he retires, on reaching his house,

shortly after midnight. He talks with few persons, shuns large gatherings, reads little, and is but little interested in what he reads, because, to use his own expression, 'his memory is always in his calculations.'" In short, while his memory for numbers is abnormally developed, all other sides of his intellect are atrophied. The tests which Sign. Guicciardi and Ferrari undertook along other lines than that of figuring failed signally, because of his lack of interest and attention. He was always inquiring what was the use of doing these—they were not in his line at all. For this reason many of the usual tests had to be abandoned or altered so as to bring in merely numerical data. However, these negative results are as truly indicative of his real nature and disdisposition as the successful tests, which they serve to conform.

**Visual Perception of Depth.**—Some experiments on the visual perception of depth are reported by M. B. Bourdon in the "Revue Philosophique" for January, which, if they warrant the deductions which he draws from them, will necessitate a modification of the accepted theories of space perception. The special object of the experiments was to isolate the depth data furnished directly by monocular and binocular vision, respectively, from the elements of judgment ordinarily attaching to them—such as known size, brightness, number of intervening objects, etc. To accomplish this the tests were made in a long hallway in the cellar of a large building and at night, when the cellar was completely dark. Two lanterns were placed at different distances, their light being of so small an intensity that the hall itself was not illumined; the effect was merely of two bright points of light.

In the monocular tests, the lights were first placed in position, and the subject was then led with eyes blindfolded to the spot chosen; one eye remained covered during the experiment. The subject was asked to determine which of the lights was the nearer. The experiment was tried with five subjects, and for distances ranging from 1 to 30 meters. It was found that even with the latter difference there was no preponderance of right judgments, while a slight difference of intensity between the lights led uniformly to a judgment in favor of the brighter. The author concludes that the muscular sensations accompanying changes of accommodation play no part in the estimate of depth, at least for distances greater than one meter.

For the binocular tests the author used two hallways at right angles to one another, the subject being stationed at their point of intersection. One of the lights was placed in each of the halls. When the further light was 25 meters distant, right answers were generally given when

the other light was 6 meters or less; if the nearer light was 10 meters distant or more, the wrong answers predominated; the threshold value was about 7–8 meters, or a difference of 17–18 meters. Another set of experiments was tried in which the subject was asked to estimate binocularly the absolute distance of a single light. The results showed no approximation to the truth, the estimates for 50 meters being in several cases nearly the same as those for 5 meters. According to the author, the muscle sensations—in this case of convergence—play no appreciable part here; it is only the bi-retinal assimilation of corresponding points that determines our sensation of depth. Thus our perception of depth, in so far as it is a sensation at all, and not a judgment, is really a visual function, and not a muscular one, as the commonly accepted theories incline to believe. The results seem to show that the visual *sensation* horizon is about 220 meters from the eye. The spherical shape of the heavens is due to the practical parallelism of all objects further than that distance, as determined by the minuteness of bi-retinal localization, rather than to the absence of changes of accommodation and convergence for greater distances.—H. C. W.

## ANTHROPOLOGY.[1]

**On Fossil Bird-Bones Obtained by Expeditions of the University of Pennsylvania from the Bone Caves of Tennessee.**—On the 20th of last June (1896) the writer received from Professor E. D. Cope a small collection of subfossil bones obtained by Mr. H. C. Mercer while in charge of explorations for the University of Pennsylvania in the Bone Caves of Tennessee. These bones were kindly sent to me for the purpose of having them identified if possible, and eventually described and figured. As in the case of many cave bones, they are not encased in any matrix, being to some degree pliable rather than brittle and completely fossilized. They have a rather pale clayey color, and not more than one in a dozen of them are perfect. Indeed, it is unfortunate that so many of them are in too fragmentary condition to be identified with any degree of certainty, and in the case of a few mammal bones I found in the collection no attempt was made at identification at all. Skulls and sterna are entirely absent from this collection, nearly all the specimens being long bones, with the exception of the sacral portion of one pelvis; a few coracoids and portions

[1] This department is edited by H. C. Mercer, University of Pennsylvania.

of unidentifiable scapulæ, and some odd vertebræ. Under these circumstances one is obliged to be extremely cautious and careful (especially in the case of birds) in coming to an opinion as to what species the bones belonged, and whether these species are still represented in existing avian faunæ or are now to be reckoned among the extinct forms. An example of this is well exemplified in the case of a small *humerus* from the right pectoral limb of a bird in this collection. It is evidently passerine, and may have belonged to any average finch or sparrow the size of a *Carpodacus*, the bone being 2 cms. long and having all the characters seen in the humeri of that size and in that group. It is practically impossible to identify such a specimen, especially in the absence of all of the rest of the skeleton, and the fact moreover, that it possibly belonged to some extinct finch, sparrow, or other small passerine type. For these reasons too, I pass by quite a number of fragments of avian ulnæ that belonged to various species, as well as other bones of the skeleton, naming only those that can be pronounced upon with certainty.

### Pygopodes.

*Colymbus auritus.*—Represented in the collection by a perfect left femur of an adult individual, as well as by the shaft of a left humerus, and the distal end of a tibio-tarsus. These bones correspond exactly with those found in examples of this Grebe now existing. I have compared them with the skeleton of one of the species in the collections of the United States National Museum (No. 17,873).

### Anseres.

A right coracoid; a right humerus; and the proximal moiety of a right ulna (all from adult birds) appear to have belonged to some species of anserine fowl. Doubt may rest with the humerus and ulna, because they are somewhat fragmentary; but the coracoid belonged to a duck or else a Merganser; it is about the size for *Aix sponsa.* Thus far I have not identified it.

### Gallinæ.

*Colinus virginianus.*—That the remains of the Common Virginia Partridge occurred in these caves rests upon the discovery of the right humerus of an adult individual of this species. It is found to agree exactly with the corresponding bone in specimens of this bird now existing. There is also in the collection a left humerus of a Partridge, that might easily have belonged to either a female of this species or

else to a subadult individual, or finally, to perhaps a different species. It has all the characters however, of a colinine humerus, but is smaller than the one just referred to above, and in the absence of other material I believe it to be wiser not to pronounce upon it definitely at present.

*Bonasa umbellus.*—Numerous bones of the Ruffed Grouse were discovered in these caves. I find in the collection a left humerus and a coracoid from the same side; two ulnæ, four carpo-metacarpi (one perfect, the others nearly so), and three tarso-metatarsi with the lower half of another. These bones have each and all been carefully compared by me with several skeletons of *Bonasa umbellus* in my private collections, and I find that they agree in all their characters with the corresponding elements of the skeleton as now found in specimens of this Grouse of the existing avifauna.

The collection contains the right carpo-metacarpus of still another Grouse, the specimen being nearly perfect. It is but a millimetre or two shorter than that bone as it occurs in adult male individuals of *Tympanuchus americanus*, being at the same time almost identical in character, in fact presenting only such very slight differences as might be due to individual variation. This bone may have easily belonged to some form of this genus abundantly represented in the existing avifauna, and in the absence of the balance of the skeleton, I am by no means sure it did not. Possibly the former owner of it may have been a female *T. americanus*, or a subadult specimen, or a male *T. pallidicinctus* and so on; while in any event, without more material for comparison, it is hardly possible to say with certainty as to what the species was, more than it was a Prairie Hen (*Tympanuchus*).

Even still more puzzling is the presence in this collection of the tarso-metatarsus of a Grouse—a perfect bone from the right limb. It does not belong to any of the species I described from the Equus Beds of Oregon, and it is too small, and at the same time, *too stout* for any existing species of *Tympanuchus;* too big for a *Pediocœtes;* and too small for a female *Centrocereus*, yet there is no question but what it is the typical tarso-metatarsus of a true Grouse. I do not believe it belongs to the same species as the one to which the above described carpo-metacarpus belonged, for the bone is not big enough for that quite, and yet is just possible that it might have done so. It is far better to wait for additional and fuller material to come to light from the locality where this bone was collected, before either declaring it to be a new species or not having belonged to one now abundantly represented in our existing fauna.

*Meleagrinæ: Meleagris gallopavo.*—The presence of the remains of the common Wild Turkey in this collection is well attested to by the following list of bones:—

Sixth cervical vertebra and the fragments of two others.

Superior extremities of seven coracoids.

Proximal two-thirds of left humerus.

Distal end of right humerus.

Fragments of the proximal ends of two other humeri.

Proximal end of left ulna.

Fragments of four carpo-metacarpi (one largely complete).

Fragment of distal end of right femur.

Distal extremities of two tibio-tarsi (♂ and ♀ ?).

Superior portions of six tarso-metatarsi and one distal end.

Three tarso-metatarsi (fragmentary), with calcars developed thereupon.

Upon comparing these bones and fragments of bones with the corresponding ones in the skeletons of *M. gallopavo*, it leaves no doubt as to their identity. And, as in this last species, very considerable difference in size is seen to exist between the sexes, as well as between the male and females when compared with the subadult individuals. Professor Marsh at different times has described three species of alleged extinct Turkeys, viz., *Meleagris antiquus*,[1] *M. altus*[2] and *M. celer*,[3] but I am very sceptical indeed in regard to the validity of the first named, *i. e.*, *Meleagris antiquus*, or in other words, I doubt the propriety of basing a new species of fossil Turkey upon "the distal end of a right humerus," as Professor Marsh has done in this case. Nor do the characters he describes for this species, as being diagnostic, hold true. It is a positive detriment to science, in my estimation, to create new species of fossil birds upon the distal ends of long bones, and surely no assistance whatever to those who honestly endeavor to gain some idea of the avian species that really existed during prehistoric times. So far as *M. altus* and *M. celei* are concerned, I can only say that I know nothing of them from a personal examination of the material upon which the species are based, and this has been refused me.

In the case of *Meleagris altus* Professor Marsh says that the length of the tarso-metatarsal is equal to 176.5 mm. (p. 261) and the present writer says that it is by no means uncommon to find the same bones in adult male specimens of *M. gallopavo* fully of that length, if not longer.

[1] Am. Jour. Sci., II, 1871, 126.

[2] Pr. Acad. Nat. Sci. Phila., 1870, 11; and Am. Jour. Sci., IV, 1872, 260.

[3] Am. Jour. Sci., 1872, 261.

The other characters Professor Marsh enumerates may each and all be due to sexual and individual variations.

In the case of *Meleagris celer* this likewise holds true, and in regard to the statement that the " remains preserved indicate a bird about half bulk of *M. altus*," may be said with equal truth of *M. gallopavo*, in which species a similar discrepancy in size also exists between the sexes and between old and young.

In other words I am of the opinion, so far as I am able to judge from his descriptions, than when Professor Marsh described his three extinct and new species of *Meleagris*, he had nothing more or less before him than the very meagre and fragmentary remains of *M. gallopavo*.[4]

*Columbidæ: Ectopistes migratorius.*—The Passenger Pigeon is represented in the collection by subfossil bones from several adult individuals, viz. :—

Two left humeri (nearly perfect).
Four fragments of humeri.
One left carpo-metacarpi (perfect).
Three carpo-metacarpi (imperfect).
Several coracoids (worn, and so doubtful).
One pelvic sacrum.
One left femur (perfect).

The several bones differ in no way with the corresponding bones as they occur in adult specimens of *Ectopistes* as they exist at the present times.

## Striges.

*Megascops asio.*—The Screech Owl is represented by a single specimen of a tarso-metatarsus—the bone agreeing completely with the corresponding one in the pelvic limb (of this species) of a skeleton in the private collection of the writer.

## Pici.

*Ceophlœus pileatus.*—A right *ulna* with the extremities of the bone imperfect represents the Pileated Woodpecker in the collection. The specimen agrees exactly with the ulna of this species in the pectoral limb of a skeleton in my own cabinets. Even the prominent papillæ of the quill-butts of the secondary feathers down the shaft (and so characteristic of the ulnæ of true Pici), agree in number and in their

[4] The relation of the specimens to the human culture layers discovered, the associated remains of the Tapir, Mylodon and other mammals identified by Professor Cope, and the shells identified by Professor Pilsbry is to be fully discussed later in the forthcoming reports of the Tennessee Expeditions of the University.

several and corresponding distances apart, in the two bones when compared.

Thus it will be seen that the subfossil bones of birds in this collection from the several Bone Caves of Tennessee (so far as I have been able to identify them with certainty), belonged only to species still abundantly found in our avifauna, or were found there. Of the species enumerated below, it may be said that the Wild Turkey and the Passenger Pigeon are on the high road toward total extinction.

| | |
|---|---|
| *Colymbus auritus.* | *Colinus virginianus.* |
| *Bonasa umbellus.* | *Meleagris gallopava.* |
| *Ectopistes migratorius.* | *Megascops asio.* |
| *Ceophlœus pileatus.* | |

To these may be added a doubtful Duck aud a Grouse, while still other bones represent species that cannot be satisfactorily identified until the skeletons are made more complete by the discovery of additional material.—R. W. SHUFELDT.

## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

**Torrey Botanical Club.**—Wednesday evening, March 31, 1897. —The first paper, by Dr. Albert Schneider, " The Phenomena of Symbiosis," and a paper by Leonard Barron on " Horticulture in Botanical Gardens," were read by title.

The evening was occupied by a paper by Prof. Edward S. Burgess on " Aster macrophyllus and its Allies," illustrated by chart of relationship and by numerous specimens. The speaker sketched briefly the history of the species *Aster macrophyllus*, in which it has been the custom of American botanists to include all large leaved Asters. He showed how diverse these Asters are, and in what confusion their assignment to a single species results, and indicated the characters according to which they form two groups each of several species and varieties.

The paper which will soon appear in print, was discussed by Mr. E. P. Bicknell, who confirmed the distinctions offered by the results of his observations about New York, and by Dr. Britton, who paid a tribute to the masterly manner in which Dr. Gray had treated the subject of the genus Aster so far as material was then available, and who referred to the special need for extended field work and further collaboration which this genus had long presented.

Tuesday evening, April 13th.—Dr. Albert Schneider presented a paper entitled "Methods Employed in the Examination of Powdered Drugs and their Adulterants."

He described certain microscopic structural features which he had investigated with a view to find characters by which to distinguish the more important drugs, giving details of such characteristics determined by him for mace, senna, leaves of Eucalyptus globules, etc.

Dr. Britton spoke of the utility of this work and of its objects in behalf of the new edition of the U. S. Pharmacopeia.

Wednesday evening, April 28, 1897.—In the absence of officers, Professor Underwood was elected Chairman of the meeting and Professor Britton Secretary pro tem. There were 26 persons present.

The Chairman announced to the Club the recent death of Dr. Emily L. Gregory, Professor of Botany in Barnard College, and remarked on her life and works. Dr. H. M. Richards, Dr. H. H. Rusby and Miss Alexandrina Taylor were appointed a committee to draw suitable resolutions and report them to the Club at a subsequent meeting.

The scientific program comprised the following papers:

1. By Professor L. M. Underwood: "Notes on the Ferns of Japan." (Abstract).

The immediate occasion of this paper was the receipt during the past year of two separate collections of Japanese ferns of about 50 species each, which, being from different portions of the island, scarcely duplicated each other. Some of the more interesting were shown, including *Camptosorus sibiricus*, *Cystopteris japonica* and *Struthiopteris orientalis.*

The insular position of Japan together with a considerable range of latitude, equalling that from St. Paul, Minn., to Mobile, Ala., gives Japan a larger proportion of ferns than we have in the United States, although the area of the islands is only that of the northeastern States as far as the Virginias together with about one-half of Ohio.

The ferns are those of temperate climates and agree well with those of the adjacent mainland so far as the latter are known. A few subtropical forms enter the flora, but the really tropical species do not reach the islands.

Many species are common inhabitants of Europe as well as the eastern United States, but the ferns of Japan offer very little support to the once prevalent notion of the great similarity to the flora of the eastern United States. In fact about as many Japanese species have as many near allies in Pacific America as in other portions of the country if we exclude the species quite generally distributed through the North Temperate Zone.

Discussing the paper, Professor Britton cited a number of instances among spermatophytes, in which species supposed to be common to Japan and eastern North America, has been shown to be distinct. He maintained that the theory of migration, as ordinarily accepted, was insufficient to account for such similarity between the floras of the two regions as actually exists. Mr. T. H. Kearney, Jr., remarked that in comparing the grass-flora of the two regions, he had found that exclusive of circumboreal species, only two species are in common.

The second paper was by P. A. Rydberg, entitled "Floral Features of Western Nebraska."

It is a popular misconception that the country from Illinois to the Rocky Mountains constitutes one undifferentiated region. In fact, there are two entirely different regions, viz.:

1. The Prairie Region, with rich loam and a comparatively good supply of rain, extending to the Eastern Dakotas, Nebraska and Kansas.

2. The Region of the Great Plains, with dry, hard soil and scanty rain-fall, comprising the western portion of said States, eastern Colorado and Montana and the lower portion of Wyoming. In Nebraska the prairie region includes the eastern and south central portion of the State. The north central portion constitutes a region unique to Nebraska, the Sand-Hill Region, spoken of in one of the February meetings of the Club. Mr. Rydberg corrected a statement made by him then, viz., that he had seen "blow outs" in that region 300 feet deep. He had intended to say 300 feet in diameter and 60 to 70 feet deep.

The western portion of the State is made up of high plains, except a small portion of the northwestern corner containing the "Pine Ridge" and the "Bad Lands" of White River and Hat Creek. The plains have very few rivers, and the drainage is mostly by means of "sand-draws." Seen from a hill a sand-draw resembles a well beaten and winding sandy road. It is a stream with no visible water. The water is running from one to fifteen feet below the surface. Even the larger streams as the Lodge Pole and South Platte sometimes sink down in the sand.

The plains are mostly covered by short grasses, the so-called Buffalo grasses. In the hot, dry autumn, these become self-cured, and form an excellent winter pasture for the stock. A little hay is cut on the lowlands and fed to the animals during snow-storms. Otherwise the cattle and horses feed out during the whole winter. The Buffalo grasses are: the original Buffalo grass *Bulbilis dactyloides*, Blue and Black

grama *Bouteloua oligostachya* and *hirsuta*, and " Nigger Heads," *Carex filifolia*.

In a region where the rain-fall is comparatively scant and distributed only during certain seasons of the year, the plants must be so constituted as to be able to withstand a good deal of drought. In other words, the evaporation must either be reduced to a minimum or the plant must have special stores of water. The plants peculiar to this region may be divided in the following groups:

1. Very hairy plants generally covered by thick pannose pubescence, which retain the moisture, as species of *Eriogonum, Astragalus, Eurotis, Senecio, Evolvulus* and *Artemisia*.

2. Plants with glaucous foliage having a hard epidermis, as *Yucca glauca, Rumex venosus, Argemone alba*, and several grasses.

3. Plants with white, often shreddy bark, as species of *Mentzelia* and *Anogna*.

4. Plants with very narrow and often involute leaves, as *Lygodesmia juncea* and *rostrata* and several grasses and sedges.

5. Plants with fleshy stems in which the surface is reduced to a minimum and no leaves, as the *Cacti*.

6. Plants with a deep-seated, enlarged root, as the Bush Morning-glory *Ipomœa leptophylla*, and the Wild Pumpkin *Cucurbita fœtidissima*. Mr. Rydberg had seen a root of the former 3 feet long and almost 2 feet in diameter.

7. Plants covered with glands, containing essential oils, as *Dysodia papposa* and *Pectis angustifolia*. The oil is supposed by some to have a cooling effect, partly by taking up heat when evaporated and partly by surrounding the plant by a cooler atmosphere, their specific heat being much less than the air.

Numerous specimens were exhibited.

Three papers followed by Dr. J. K. Small, " (a) The Sessile-flowered *Trillia* of the Southern States," (b) " Notes on Epilobiaceæ." Both papers are published in the April issue of the *Bulletin*.

Dr. Britton exhibited a specimen of *Silene conica* L., collected by Mr. A. D. Selby at Clyde, Ohio. This species is a recent immigrant from Europe.

N. L. Britton, *Secretary, pro tem.*

**New York Academy of Sciences.**—Biological Section.—April 5, 1897.—The Chairman, Prof. E. B. Wilson, in the chair. Twenty-two persons present. Prof. Osborn moved that a committee be appointed to consider and take action on the question of postage on

Natural History specimens. The Chair appointed Doctors Dyar and Dean and Prof. Stratford.

Professor Bristol offerred his resignation as Secretary. It was accepted, and the election of his successor was laid over until the next meeting.

Prof. Osborn reported upon the phylogeny of the early Eocene Titanotheres, showing that they are divided into two distinct series included under the genera Telmatotherium and Palæosyops, both of which independently acquired horns. The Telmatothere line begins with *T. boreale,* a form which Cope referred to as Palæosyops. It is distinguished by animals with long narrow skulls and high stilted feet, and undoubtedly represented the upland types of the family. The Palæosyops line, as suggested by Earle and Hatcher, passes through *P. laticeps* and *P. manteoceras* and leads up to Dipladodon, the larger species of which surpass in size the smaller Titanotheres of the Oligocene. This main line gives off several collaterals, such as *P. paludosus.* Lambdotherium does not belong in the *Titanothere phylum* at all.

A second note related to a division of the two groups of placental mammals, the Meseutheria and Ceneutheria. The former, since Wortman's demonstration that the Ganodonta are ancestral edentates, must now embrace this division, besides the Creodonta, Lemuroidea, Tillodontia, Insectivora, Amblypoda and Condylarthra.

The third note related to the origin of the typical mammalian types of teeth among the Theriodonta, Cynodontia and Gomphodontia of the Triassic. It is especially noteworthy that the Gomphodontia afford a demonstration of the origin of Multituberculate teeth from a tritubercnlate ground plan, as hypothetically assumed by the speaker some years ago.

Mr. Bradney B. Griffin reported that in Thalassema (one of the Echiurids) the spireme occurs in minute ova (3 micra in diameter) floating clusters in the body cavity. The spireme segments into one-half the somatic number of chromosomes, which by partial longitudinal splitting pass into flattened ellipses. These elongate, and during the growth period become twisted and distorted, and their true shape thereby obscured. While entering the first polar spindle they appear as loose open rings or compact rods (bivalent). These by concentration and looping-up form crosses, opposite arms of which are attached to the "Zugfasern." During metaphase the crosses become drawn out into flattened ellipses which split across into two V's with closely apposed limbs. At telophase the latter separate at the angle and diverge in the second polar mitosis. No longitudinal splitting of the V's occurs.

In Zirhæa (Lamellibranch) the process is identical, although more obvious by reason of the less close apposition of the halves of the rings and V's. The conclusion is that in both forms a reducing division takes place.

Mr. J. H. McGregor offered a preliminary report on the development of the Spermatozoa in Amphiuma.

Prof. F. E. Lloyd's paper on Pholadidæa of the Pacific Coast was read by title.

May 3, 1897.—The Chairman, Professor E. B. Wilson, in the chair. Fifteen persons present. Mr. Gary N. Calkins, of Columbia University, was elected Secretary.

In the absence of Dr. Dyar, Chairman of the Committee appointed to consider the question of postage on Natural History specimens, Professor Stratford reported that the Postmaster General had been notified, and that the matter had received due consideration.

Upon behalf of the Committee appointed to draw up a resolution relating to the death of Professor Cope, Professor Osborn delivered a brief eulogy of the great naturalist, pointing out the especial features which have made his work famous and have given him such a high position in the history of Natural Science. He dwelt especially upon the fact that Professor Cope prosecuted five great lines of work simultaneously, and that in each he acquired a commanding position. He also spoke of some of his generous qualities as a fellow scientific worker, especially his liberality in the loan of collections and generous recognition of the work of others. Finally, he alluded to his remarkable independence and fortitude of character, and persistent devotion to science, even with limited resources. His death leaves a vacuum especially in the line of able and accurate criticism of contemporary work. Professor Osborn concluded by submitting the following resolution:

The members of the New York Academy of Sciences desire to record their admiration of the noble services to Science of the late Professor Edward D. Cope. Since 1859, when he offered his first contribution to the Philadelphia Academy of Sciences, at the age of nineteen, he has been a devoted and brilliant investigator in five great branches of Natural History, ichthyology, herpetology of the batrachians and reptiles, mammalian palæontology, historical geology and philosophy. In each he has long been an acknowledged leader, and his combined knowledge of all has given his researches a philosophical breadth, grasp and permanence, which place him among the great masters of Comparative Anatomy, Cuvier, Owen and Huxley. We deeply regret that his untimely death has cut short his life work, and feel that the loss of his

keen critical and productive faculty deals a blow to the cause of comparative anatomy of the vertebrata throughout the world which can hardly be measured. We tender to the American Philosophical Society and to the Academy of Natural Sciences of Philadelphia, of which Professor Cope was a life long member, an expression of our deep regret at their loss, and of our readiness to coöperate with them in the establishment of some suitable memorial.

Signed { HENRY F. OSBORN.
J. L. WORTMAN.

Mr. H. E. Crampton, Jr. gave a brief abstract of a paper by F. C. Baker on "Notes on Variations in the Apex of Gasteropod Molluscs."

Professor Bashford Dean and Mr. F. P. Summer reported on the spawning habits of *Petromyzon wilderi* at Van Cortlandt Pond.

Mr. H. E. Crampton, Jr. reported on some Coalescence-Experiments with Lepidoptera.

A paper on the "Vertical Distribution of Plankton in Deep-Sea Collections from Puget Sound" by Prof. James I. Peck and Mr. N. R. Harrington was read by title.—GARY N. CALKINS, *Secretary.*

**The Academy of Science of St. Louis.**—At the meeting of the Academy of Science of St. Louis on the 7th of June, 1897, twenty-one persons present, Mr. Robert Combs, of Ames, Iowa, presented a paper entitled Plants Collected in the District of Cienfuegos, Province of Santa Clara, in 1895–1896. The paper embraces the results of a collection extending from the commencement of the rainy season of one year until the close of the dry season the following spring, the territory covered by the collection lying between the entrance of the Bay of Cienfuegos, on the south coast of Cuba, up the bay and the river Damuji to Rodas, and extending back from the river to Yaguaramos and almost to the Cienega de Zapato, a region including nearly all kinds of soil and condition found upon the island, except those of the mountain regions and the mud swamps. A brief statement was made concerning the origin of the Cuban flora and its affinities with that of continental Central America, rather than the geographically nearer Floridan region.

The paper comprised a full catalogue of the collections made, which had been determined at the herbarium of Harvard University, and of which several sets had been distributed to the larger herbaria.

Professor F. E. Nipher made some remarks on the difficulties yet involved in the theories of the ether.

WILLIAM TRELEASE, *Recording Secretary.*

## SCIENTIFIC NEWS.

The following changes made by the Postal Congress will interest naturalists generally:—

1. The principal treaty, the entry of Corea into the Postal Union, the declaration of the Orange Free State, which had not yet sent a delegate to Washington, that it hoped in a short time to enter into the Union; the declaration of the empire of China, represented in the congresses, that it will adhere to the union as soon as the organization of its service permits it.

2. Uniform colors have been adopted for postage stamps.

3. Postal cards unpaid are subject to a double tax, that is four cents in place of a tax equal to that upon letters unpaid, which is 10 cents.

4. Circulars produced on a typewriter in quantities of twenty circulars or more, all of the same character, are admitted at same tariff as are printed circulars.

5. Samples of merchandise are admitted up to 350 grammes, except in the case of a contrary arrangement, when the maximum weight will be 250 grammes.

6. Objects of natural history, animals, dried plants or preserved zoological specimens are admitted as samples.

7. The question of the creation of a universal postage stamp has been negatively decided on account of the difficulties which will occur in putting in practice that important innovation, and especially because of the diversity of the units of money of the various countries.

The next session of the Congress, the sixth one, will be held at Rome, Italy, in February, 1903.

In a letter to *Forest and Stream*, Mr. Bainbridge Bishop deprecates the action of the U. S. Fish Commissioners in stocking the trout and land locked salmon lakes with smelt. While it is true that adult trout fatten on the smelt, the smelt can also fatten on the young trout and salmon, the smelt being 1,000 to 1 in the majority. The absence of trout in Lake Champlain from Westport to Cumberland Head, an ideal lake trout water, he attributes to smelt which are found at all times of the year in all the deeper parts of the lake, and in the identical depth of water that would naturally be inhabited by young and adult trout. His observations go to show that the introduction of smelt into the great lakes would be almost a national calamity, foretokening the extinction of trout fishing, both commercial and sporting.

Prof. G. O. Sars who has for many years been studying the various groups of Crustacea has in preparation a complete account of the Crustacea of Norway, and his work is now in course of publication by the Bergen Museum. All the known Norwegian species will be described and figured. Parts III and IV of vol. I, containing descriptions and illustrations of five families of Isopods, viz., Anthuridæ, Gnathiidæ, Aegidæ, Cirolanidæ, and Limnoriidæ, have just been issued.

Among recent deaths we notice: H. d'Achon, coleopterist, at Orléans; Dr. Maurice Teinturier, coleopterist, at Clayeures, France; Edmund Neminar, formerly professor of mineralogy and petrology in Innsbruch, on April 10, 1897, at Vienna; Karl Kölbel, custodian of the Natural History Hofmuseum at Vienna; Ludwig Juranyi, professor of botany at Budapest, February 27th; Dr. A. Kumgott, professor of mineralogy at Zürich, March 15, aged 79.

Dr. W. H. Evans, of Washington, D. C., has gone to Alaska for several months to investigate the agricultural resources and possibilities of that portion of the territory lying south of the Aleutian peninsula. He will report to Congress as to the advisability of establishing experiment stations there. Dr. Sheldon Jackson is to collect similar information regarding the Yukon Basin.

Professor Nelson, the University of Wyoming botanist, will make an excursion into the Red Sea Desert. This tract of land has never received a botanical investigation, and the professor has planned to make three other trips into the desert during the summer. He expects to obtain many rare botanical specimens.

A proposition is under consideration in the English scientific societies for the establishment, in commemoration of the sixtieth year of Her Majesty's reign, of a Victoria research fund, to be administered by representatives of the various scientific societies for the encouragement of research in all branches of science.

Professor Bruner, of the University of Nebraska, has sailed for Buenos Ayres, where he will spend a year investigating the injurious locusts which have, of late, increased enormously in three of the eastern provinces of the Argentine Republic.

Dr. Ludwig Heim goes to the University of Erlangen as professor extraordinarius of bacteriology; Dr. Vladislaw Szymonowicz of Cracow goes to Lemberg as professor extraordinarius of histology and embryology in the university there.

At its commencement exercises, on June 15th, Johns Hopkins gave its first doctors' degrees in medicine. One of the recipients is Miss Mary S. Packard, the only one of her sex in the class.

The Field Columbian Museum, Chicago, has purchased from the widow of Dr. Arthur Schott, the plants collected by him in Campeche, Tabasco, Upper Mexico, Hungary, and elsewhere.

Dr. Edward Fischer has been advanced to the position of professor of botany in the University of Berne; Dr. Gaupp to the professorship extraordinary of anatomy in Freiburg.

The gold medal of the Linnean Society of London has been conferred upon Dr. Jacob Georg Agardh, Emeritus Professor of Botany at the University of Lund.

The endeavor, at Cambridge, to open a possibility for the reception of degrees by women has been defeated by an overwhelming vote of 1707 to 661.

Drs. E. Barclay-Smith and F. C. Kempson have been appointed senior and junior demonstrators of anatomy in the University of Cambridge.

Johann S. Kubary, who probably knew the islands of the South Sea as well as any one, died at Ponapé, Caroline Island, the last of October, 1896.

The general board of studies at Cambridge propose to establish a lectureship in experimental psychology at a stipend of £50 per annum.

The degree of Doctor of Philosophy was conferred upon Mr. Roscoe Pound by the University of Nebraska at its recent commencement.

Mr. Edward Dodson has left England for Morocco, with the object of investigating the fauna of the country around the Atlas range.

Dr. E. Fischer has been made full professor of botany in the University of Berne and director of the botanical gardens there.

Professors Bütschli and Weismann have been elected to corresponding membership in the Academy of Sciences of Berlin.

Dr. Georges Ville, professor of vegetable physiology in the Museum of Natural History at Paris, died February 23, 1897.

Professor Conway Macmillan goes to Europe for the summer on business connected with the University of Minnesota.

The Royal Society of Edinburg has elected Professors Zirkel, Heidenhain and Cohn to honorary membership.

Mr. W. Garstang has been appointed naturalist to the Marine Biological Association at Plymouth, England.

Mr. Robert Douglas, well known in the line of arboriculture and forestry, died June 1st at Waukegan, Ill.

Dr. J. S. Kingsley is to spend the summer in Jamaica, as also is Dr. J. E. Humphrey and Dr. W. K. Brooks.

Dr. W. B. Pillsbury has been elected to an instructorship in psychology at the University of Michigan.

Dr. Johannes Martin has been appointed director of the Natural History Museum in Oldenburg.

Miss Mary E. Pennington has been made fellow in hygiene at the University of Pennsylvania.

Dr. P. Francotte has been elected professor of embryology at the University of Brussels.

Prof. J. L. Prevost has been made professor of physiology in the University of Geneva.

A gift of $100,000 was made McGill University by the will of the late J. H. R. Molson.

The Catholic University of America has received $5,000 as a foundation for a fellowship.

Dr. H. K. Wolfe has resigned the chair of psychology at the University of Nebraska.

Dr. J. J. Zumstein has been made professor of anatomy at the University of Marburg.

Dr. J. H. Leuba has received a position in psychology at Clark University.